GE Medical Systems

Technical Publication

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Revision 3

GE Medical Systems
Precision MPi® Operator Manual

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Appendix A Generator Exposure Tables

Appendix B Accuracy Of Indication With Light Field-Indicator

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Revision history:

Revision	Revision date:	Changes made:	On pages:
Prelim	4 July 2003	Preliminary version approved	All pages
Prelim. B	3 October 2003	Product name changed Stand replaced by positioner	All pages
Prelim. C	14 November 2003	Safety chapter updated Table of contents redesigned	All pages
Revision A	8 January 2004	Revision A approved	All pages
Revision B	17 May 2004	Frontpage: UL + CE logos added Overrule replaced by Security override Lbs and Inches added 1.2 System variations 2.3.1 Press 'Main Menu' to disable irradiation 2.2.3 + 2.5.1 Labels updated/added 2.5.2 Caution about Medical Electrical Equipment added 2.5.3 Max. table load changed to 450 lbs + Optional Extra Table load capacity described 3.1.2 Warm up procedure added + touch screen main menu updated 3.1.3 Updated 4.1.5 Cannot be closed when DICOM job is pending 4.3.1.2 Brightness and Contrast updated 4.3.1.3 AIO + Brightness+Contrast updated. DSA-features added. 4.3.1.4 Brightness+Contrast updated 4.4 DSA feature only 5.4.1 Button layouts updated + Heat units + AEC Lock + Back/Main Menu described + Time zero updated 5.4.2 incl. submenus moved after Control panels 5.4.3 – Pulsed Fluoro + ABS + mA/ms + focal spot size added 5.4.3 Description of button 22 added 5.4.5 incl submenus: Cross references added 5.5.1 Factory default Note added 5.5.2 and submenus: Moved to Chapter 12 5.6 DAP Reset/Test/Print sections added 6.2.1.1 Pulsed Fluoro deleted, Fluoro Loop acq. Rates updated 6.2.3 Fps updated 6.2.5 GUI shutter added 6.2.8 Multiformat Display deleted 7.1.3 Thumbnail Right click menu as separate submenu + all functions described. 7.2.1 Loop lock description added 7.4.1 deleted as separate item 7.11.1 section updated 7.13.6.2 new text	

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Revision B (continued)		7.19 Section updated 8.13 Creating CD's section added Chapter 8: Print replaced by Expose + various updates 8.11. Cross-references updated 8.11.5 Missing items added 9.1 Caution added 9.2.2 NOTE added 9.3.1 Note added 9.4 Note deleted 9.4.2 Note added 9.6 Eraser deleted 9.7 QCA Processing added Chapter 10: frequency added 10.1.2 Warning added + Caution deleted Chapter 11: Load limitations on accessories added 11.2.12 Extra table load capacity added Chapter 12 Added
Revision C	2 March 2005	GE part# added Measures in inches added New screen shots inserted Cross references updated Emergency power off replaced by Emergency Stop 2.2.1 Description of deactivation of stops added 2.2.2.3 description of security override improved 2.3.1 X-ray lock button replaces Main Menu 2.3.1.15 Fluoro warning section added 3.1.1 RTP power on section added 3.2 Warning removed to 3.2.3 3.2.1 Section on switching off the RTP added 3.2.3 Reference to powering down the PC deleted 3.3.2.1 Section on continuing AP/PA turn upon stop added 3.3.2.5 Improved description of collision message + overrule replaced by override. Warning from 2.2.2.3 added + Collision against floor text deleted and floor added to collision against ceiling 3.4 Removable grid – New section added 4.1.2.1 Sequence information, point 2: sequence replaced by series + reference to chapter 4.4. on programmable sequences added 4.1.2.5 point 4: Add 'and in the lower right corner of the main image screen if the image is currently displayed. 4.1.3 in Caution text: lower replaced by upper 4.1.4 (Option) added to headline and text on optional deleted in text below 4.1.5 2nd paragraph edited: new text on transferring images closing a patient added 4.3.1.2+4.3.1.3+4.3.1.4: Gamma select button and section added 4.3.3 Batch print edge level – print sequence operations: 'if PACE is selected' added twice 4.4 DSA only deleted in headline and in text 4.4.1+4.4.2: The right-click- menu will be displayed added to point 1

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Revision C (Continued)		5.1 Grid added to 9. Image Intensifier touchguard 5.2 angulation and movement descriptive points delete 5.4 Paragraph 2 deleted 5.4.1 Touchscreen divided in 5.4.1.1 General functions, 5.4.1.2 Radiography and 5.4.1.3 Fluoroscopy 5.4.1.2 Density up/down changed to Dose, selectable in dose levels A, B and C, doubling the dose for each step Image receptor buttons removed to 5.4.1.1 + buttons are no longer selectable but will be selected automatically Description of X-ray lock added, description of delta dose changed 5.4.2 Description of joystick movements for left/right suspension and AP/PA position added. Added reference of numbers in left column to page 5.18 Button # 20+21 Warning symbol added Button #22 deleted Button #23, Text added: Note that the c-arc will move as well in order for the table to move as close to the floor as possible Button #26 + 29: Added that movements will be opposite to PA when II is in AP position Button #32: Text from 2.2.1 on emergency stop added 5.4.3 Optional deleted in headline and text 5.4.3.1 Shut Down button description added 5.4.3.1.1 Density replaced by Dose 5.4.3.1.3 Patient dose data measured in mGycm2 + DAP and Error message line deleted 5.4.4 Pointing device given separate headline Improved description of Right-click menu + description added to table + new display and functions description of Start Service Application. Improved description of Exit Application 5.4.4.2 Keyboard removed to 5.4.4 5.4.5.1+5.4.5.2 RF deleted from RF/DSA 5.4.5.5 Buttons and descriptions of Re-registration and Carry-over added 5.5 removed to 5.4 6.2.1.1 256 MB deleted + store loop added that function can be made from RTP 6.2.3 Acquire rate added BC and RA 6.2.5 GUI shutter replaced by Right-click menu Two new sections on RA and BC added as point 6.2.4 and 6.2.5 7.1 DICOM network: 'or printer' added 7.1.4 Delete sequence: frames replaced by images 7.2 'DSA and' added to roadmap sequence + mask frame 7.3 MID = Multi Image Display 7.4 ShotSave images added: prior to their being saved Using shot save cursor added as headline + reference to Mark Image for Delete added under notes 7.6 Add: 'If Yes is selected, the' to Delete frame in single and multiple image display 7.7 improved description on brightness and contrast adjustment

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Revision C (Continued)		7.9 Delete sentence: 'The active edge setting…..' + add NOTE concerning edge setting default 7.13.5 Headline changed to Delete/Edit/Move Text annotations Description of how to move text annotation improved + NOTE on attaching a pointer to a text added 'Copy to Frames' description added 7.13.6.1 improved description on moving pointers + Description added on lengthening or shortening arrows 7.16 DSA only added to headline 7.17 Real-time subtraction is made on DSA systems 7.19 Added section on re-registration of parts of the image + Carry over 7.20 section on Display LUTs added 8.2.2 As acquired delved and description of As reviewed added + Configure print changed to configure expose 8.4 + 8.6 Expose changed to Print+ as acquired deleted 8.8 First sentence deleted 9 Numbering sections changed + QCA processing added: DSA only 11.1.2 Recommendation added that fixations bands or similar always be used for safety 11.1.3 Recommendation added that straps should always be used to help securing the patient 11.1.7 Delete: For extra table load capacity, see section 11.2.12 11.2.11 Description improved and section removed to 3.4 11.2.12 section deleted 11.2.12 (new) cassette holder added 11.2.13 Accessory rack added 13 Chapter added
Revision 1 (D)	12 August 2005	Footer and Header changed on all pages Front page changed 2.2.1+5.4.2+5.4.10: Emergency stop: Activation does not cause renewed activation of X-rays to be locked 2.3.1.2 Field of Views sizes corrected 2.5.1 + 2.5.3: Table load limitation either 205 or 162 kg 3.3.2.1 + 3.3.2.5 + 5.4.2: Warning concerning the use of accessories during AP/PA mode changed added 3.4: Improved description on how to remove the grid 5.4.2: Added tip on resetting collimator blades 6.2.3: Use of injector synchronization added more details 10.6.2: WEEE label added 11: Warning about the use of accessories during AP/PA mode change and normal operation added
Revision 2 (E)	3 April 2006	Generally: Screen dumps updated Frontpage: CE-label removed to Chapter 1.2 2.5: Applicable standards updated 2.5.3: Power requirements for 115V added 3.1.2: Tube warm up procedure corrected 3.1.3 + 3.2.4: Note added that Digital Imaging System be restarted every day 3.2.4: Note about pending DICOM jobs added

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Revision 2 (E) (continued)		4.1.2.1: Sequence information section corrected 4.1.2.2+4.1.2.3+4.1.2.4: Added that warning will only appear if configured in Service Application 4.1.2.5: Sequence numbering corrected 4.1.4.1 Accessing Worklist + 4.1.4.2 Setup Automatic Query to search for patient files + 4.1.4.3 Manual Search for a specific patient file replaced by new text 4.3: Note about Enabling AIO added 4.3.1.2+4.3.1.3+4.3.1.4: Invert/On/Off replaced by new text on Contrast Display Polarity + new text on Gamma select added 4.3.1.3: Text about AIO replaced + Text on brightness simplified + DSA Landmarking updated 4.3.1.4: Text on Brightness and Contrast simplified 4.3.3: PACE printing replaces 'the Batch Print File and Print Sequence operations if PACE is selected' 4.3.4: Auto Send simplified + Batch Device polarity + Annotations corrected 4.4.1: Item 12 and forward updated 5.4.1: Added that Prep and Expose buttons on Generator Touch screen foot are disabled 5.4.5: AIO function updated 5.4.6.2: Study , Thumbnails and Arrow definitions moved to Expanded Control box (5.4.6.3) 5.4.6.5: Re-registration and Carry over moved to new chapter on BC/RA mode 6.2.1.1: Updated 6.2.1.3: Replaced by new text 6.2.2: Fluoro Video Bypass deleted 6.2.3: Added that photospot can be acquired using hand switch 6.2.7: Text on Hiding Tool panel added + GIM text + GUI shutter texts deleted 6.2.8: Chapter on MAG modes replaced by new text 6.2.11.2: Zoom function added 7.1: Text on sequence selection updated 7.3.2: New chapter on Loop Lock added 7.7: Chapter replaced by new text 7.10: Text on Panning replaced by new text 7.19: Re-registration corrected and new chapter on 3-split re-registration added 7.20: New chapter on Carry-over Re-registration added 8.8: Chapter on Selectable Print Font deleted 8.11.7: Transfer status updated 8.13: Text on Creating CDs updated 9.1.2+9.1.3+.9.1.4: Text on PhotoFile added 9.2: QCA processing replaced by new text 13.3: Description of Digital Imaging System messages and errors added

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Revision 3	7. August 2006	5.4.1 and 5.4.3: Screenshots changed to show dose / dose rate instead of DAP / DAP rate. 5.5: Description of DAP function replaced by description of DOSE display function.

7. August 2006

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1.1 INTENDED USE OF GE PRECISION MPI

GE Precision MPi is an all-digital multipurpose tilt-C X-ray system intended for a multitude of diagnostic procedures including: Radiology, Fluoroscopy, Interventional procedures, Vascular and non-vascular procedures, Angiographic studies, and Specialized applications.

The equipment, which allows for both AP and PA projections, is suited for RF examinations as well as vascular and non-vascular interventional procedures. The system also provides for high level fluoroscopy in pulsed or continuous modes.
GE Precision MPi consists of a floor-mounted positioner with a tiltable patient table. The C-arc, mounted to the positioner, supports both Image Intensifier and X-ray tube/collimator. The C-arc can be moved along and around the patient table.

1.2 ABOUT THIS MANUAL

This manual is intended to assist the user and operators in the safe and effective operation of the equipment described. Do not operate the equipment until this manual has been carefully read and understood.
Keep this operator's manual with the equipment at all times, and periodically review the operating and safety instructions.

Some of the features described in this manual may vary or not be available to you depending on the system's configuration. This manual refers to DSA functions that may not be available in your system. For R&F only systems, ignore references to the DSA functions.

Please pay particular attention to NOTES, CAUTIONS AND WARNINGS.

This symbol indicates a Warning or an issue to be cautious about
When the symbol is used on hardware components, it indicates a requirement to refer to the user manual for details.

WARNING: Statements of such art are important and if not followed could cause fatal or serious injury to the operator, patient or any other person near the equipment or could result in misdiagnosis. Warnings are critical to proper operation of the system within regulatory guidelines.

CAUTION: Follow the directions written in this manual carefully. If these directions are not followed this could cause danger to the operator, patient or any other person near the equipment, loss of patient data or could cause damage to the equipment

NOTE: This message requires specific attention but the contents do not include any risks injuries to the patient or the user or to damaging the equipment.

Operate this manual with careful consideration of all safety precautions and warnings given in this manual for the purposes for which it was designed. Incorrect use or operation of the equipment releases the manufacturer from any responsibility in case of non-compliance, damage or injury.

Do not make any changes in the configuration of the equipment if you have not received appropriate training. Do not use other spare parts than those recommended by manufacturer or his agent.

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Do not operate the GE Precision MPi system except in accordance with information included in this manual, and any additional information provided by the system manufacturer and/or competent safety authorities.

Do not use the equipment if you have not received appropriate training in the correct and safe use of the equipment by manufacturer or any of him appointed instructor. Never allow unqualified personnel to operate the system.

This x-ray unit may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed.

DO NOT operate this system if there is any uncertainty as to the proper functioning of the system.

Manufacturer of GE Precision MPi is:

NRT-Nordisk Røntgen Teknik A/S
Birkegaardsvej 16
8361 Hasselager
Denmark

Tel. +45 8628 3500
E-mail: nrt@nrtxray.com

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2.1 INTRODUCTION

This manual is intended to assist the user in the safe and efficient operation of the system described herein. This system must be used in accordance with all safety procedures described in this manual. The system must not be used for purposes other than those for which it was designed. Only personnel possessing recognized relevant qualifications, including adequate training in radiation protection, should use the system.

Changes and/or additions to the system described herein should be performed only by NRT, or by third parties expressly authorized by NRT to do so. Such changes and/or additions must comply with all local regulations, as well as accepted standards of good practice. As with all technical apparatus, the system described herein requires proper handling, as well as competent, routine service and maintenance as described herein.

Before operating the system, please read this manual thoroughly, paying particular attention to all warnings, cautions and notes incorporated in it.

Incorrect operation or failure of the user to maintain the system in accordance with the Maintenance Program relieves the manufacturer (or his agent) from all or any responsibility for consequent non-compliance, damage, or injury.

No practical design can incorporate complete protection for operators or service personnel who do not take adequate safety precautions. **Only authorized and properly trained service and operating personnel should be allowed to work with this X-ray system.** The appropriate personnel must be made aware of the inherent dangers associated with the servicing of high voltage equipment and the danger of excessive exposure to X-ray radiation during system operation.

WARNING: Proper use and safe operating practices with respect to this x-ray system are the responsibility of the users of this system. NRT A/S provides information on its products and associated hazards, but assumes no responsibilities for after-sale operating and safety practices.

NRT A/S accepts no responsibility for any system component not maintained or serviced according to the service and installation manual or any system component that has been modified in any way.

NRT A/S also assumes no responsibility for x-ray radiation overexposure of patients or personnel resulting from poor operating techniques or procedures.

WARNING: This x-ray unit may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed.

WARNING: This X-ray equipment may only be operated in medical rooms which meet IEC and FDA requirements.

NOTE: Do not connect unapproved equipment to the rear of the console. Incorrect connections or use of unapproved equipment may result in injury or equipment damage.
Consult your service representative if external equipment is to be connected to this system. Printers or peripheral devices should be IEC 601-1 approved

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if located in the patient area, and IEC 950 approved if outside the patient area.

CAUTION: Do not exceed the tube maximum operating limits shown in Chapter 2.5.3. Intended life and reliability will not be obtained unless the system is operated within published specifications.

CAUTION: Do not attempt to alter any system software. Doing so could disrupt the functioning of the instrument and result in loss of images. Use of any software not provided by NRT or other system component suppliers is strictly prohibited!

WARNING: Do not attempt to alter any system hardware components. Doing so could disrupt the functioning of the system and result in loss of images. Use of any hardware components not provided by NRT is strictly prohibited! This includes peripherals (mouse, keyboard, monitor, etc.). Service Personnel should refer to the Spare Parts List in the Technical Manual for applicable part numbers.

WARNING: The PC cabinet should not be positioned within the patient vicinity (must be outside 6 foot radius of diagnostic area).

WARNING: The power source used for the system must meet the Power Supply requirements defined in the Site Planning Guide. Use of the system outside of these limitations will void the Product Warranty.

Precision MPi is classified according to IEC 60601-1 and UL60601-1.

Type of protection:	CLASS I.
Degree of protection:	TYPE B.
Degree of protection against liquid:	ORDINARY EQUIPMENT.
Methods of sterilization/disinfection:	DESCRIBED IN DOCUMENTATION
Degree of protection against gases:	EQUIPMENT NOT SUITABLE FOR USE IN THE PRESENCE OF A FLAMMABLE ANAESTHETIC MICTURE WITH AIR OR WITH OXYGEN OR NITROUS OXIDE.
Mode of operation:	20%, INTERMITTENT OPERATION; 2 MIN. OPERATION, 8 MIN. REST.

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2.2 EMERGENCY PROCEDURES

2.2.1 EMERGENCY STOP

In case it is required to stop the movements of the stand quickly in an emergency situation like patient distress, fire, power supply failure or other situation, activate one of the red emergency stop buttons:

Emergency stops:

Emergency stops are located on the left side of the positioner (when seen from the front) and on either of the two control panels in the control room or mounted to the trolley.

The **Emergency Stops** will stop all motorized movements and all electrical power to the motorized movements of the positioner will be shut off. Ongoing irradiation will continue. Note that acquired images are not lost when this button is activated because neither generator nor the imaging system is powered off.

The Emergency stop on the positioner can be deactivated pulling it out whereas the two emergency stops on the control panels must be rotated and then pulled.

Patient table down/security override:

Locate the **patient table down/security override** button on the left side of the positioner (when seen from the front of the system) next to the emergency stop.

In case of power failure, activate the patient table down button and keep it pressed until the patient table has moved to its lowest horizontal position. This allows the patient to be released from the patient table which may be very important if the patient is positioned in a head-down position. Be sure to support the patient before releasing him/her from the patient table.

Release the button and no further movements will be possible until electrical power is restored.

Note that the button has a collision-recovery function (**security override**) when the power is switched on. See Chapter 3.3.2.5 for a description of this function.

When the operator is sure that it is safe to operate the system again, reset the activated Emergency stop by pulling it out and the positioner will be functional again.

Note: The system will not be functional if the activated emergency stop has not been pulled out.

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2.2.2 ANTI COLLISION FEATURES

WARNING: The operator must be very attentive to the patient when operating the equipment in order to avoid any collision.

WARNING: None of the accessories that can be used on the positioner contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the image intensifier/x-ray tube when any accessory is used on the GE Precision MPi.

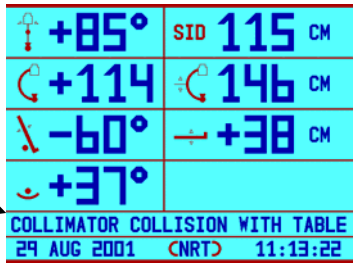
The system is equipped with different anti collision features to protect the patient from being injured due to non-patient focused operation of the equipment. The two anti collision devices are fitted to the collimator and the image intensifier as shown below:

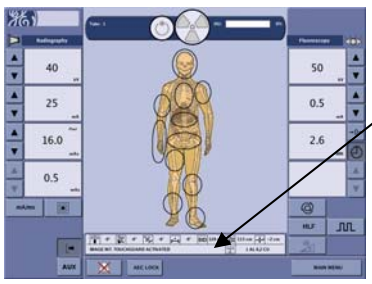
2.2.2.1 Collision with image intensifier or x-ray tube

A collision between patient/patient table and image intensifier or x-ray tube will activate a touchguard as shown on the photos above and any movement will stop. A continuous beep is heard and the light next to the anti collision button on the control panels will flash. Press the button and keep it activated until the movement is cleared from the patient/patient table again. When the audible alert is heard, the system is ready for use again.

2.2.2.2 Collision with floor or ceiling

Precision MPi is equipped with anti-collision software which automatically beeps if a collision is detected. The description of the collision can be seen on the monitor mounted to the cable guide on the top of the positioner





or on the touch screen monitor in the control room in the middle lower section of the display.

Normally, the system clears the collision automatically, but in some cases the operator will need to perform the clearance. This is done by activating the relevant joystick on the control panel.

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2.2.2.3 Security Override

If neither joysticks nor the anti-collision clearance button clear the collision, locate the **Security Override** button on the left side of the positioner and press it to recover from the collision. This operation requires two persons: one to keep the button pressed and one to operate the control panel. The control panel can only be operated when the button is activated.

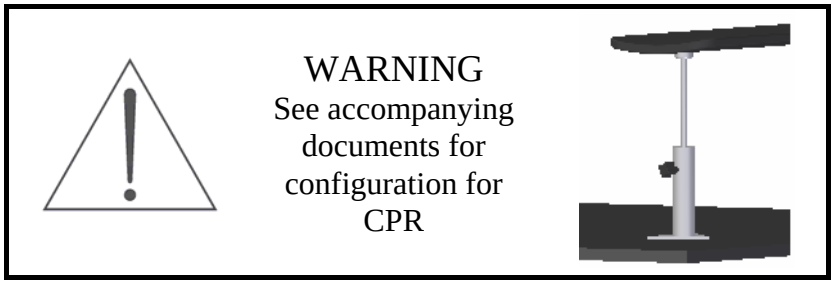
WARNING: When the **Security Override** button is activated, any movement is possible and all automatic anti-collision features are disengaged. Be careful not to cause collision with the patient and/or floor and ceiling as this may cause serious injury to the patient or damage to the system. The function is active only when the power to the system is switched on.

Note: If the power supply should fail the button activates a battery backup which moves the patient table downwards to release the patient. The button activates the battery when the power supply is turned off.

2.2.3 CARDIAC MASSAGE (CPR) ON PATIENT TABLE

WARNING: Do not attempt cardiac massage on the system unless the patient table is supported in both ends. Use the CPR support device described in Chapter 11.1.7 to support the unsupported end of the patient table. Attempting cardiac massage without supporting the patient table in both ends may cause deflection of the patient table, reducing the effectiveness of cardiac massage and risking serious injury to the patient.

The following label is attached to the CPR device:



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2.3 SAFETY PROCEDURES

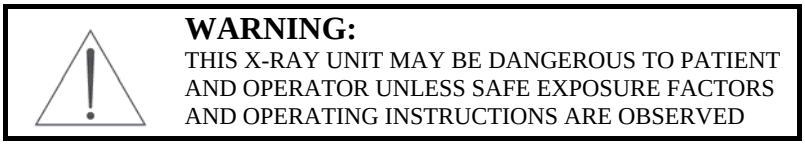
It is imperative that all Safety Procedures described herein be strictly adhered to, in order to ensure the safety of both patient and user.

The system described herein must not be used if any mechanical, electrical, or radiation-emitting component is defective, or if procedures described in the Maintenance Schedule have not been performed.

WARNING: Should any monitor, display, control, indicator lamp, or acoustic signal fail to operate, do not use the system until a repair has been affected. Operation of the system with defective components may expose the operator or the patient to radiation or safety hazards.

2.3.1 RADIATION SAFETY

WARNING: This X-ray unit may be dangerous to patient and operator unless safe exposure factors and operating instructions are observed.
The following label is attached to the X-ray unit:


WARNING:
THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT
AND OPERATOR UNLESS SAFE EXPOSURE FACTORS
AND OPERATING INSTRUCTIONS ARE OBSERVED

WARNING: Never attempt to remove, modify or over-ride any safety device on the system. Interfering with safety devices could lead to fatal or other serious personal injury.

Precision MPi is a system for fluoroscopy and radiography. All personnel in the procedure room must follow the radiation safety practices common to any system involving fluoroscopic and radiographic techniques. Nevertheless, free angulation of the beam is essential in surgical examinations, and protection against secondary radiation from the table and patient is consequently limited.

X-ray radiation exposure may be damaging to health, with some effects being cumulative and extending over periods of many months or even years.

To protect both patient and operator against radiation, always use radiation protection accessories in addition to devices which are fitted to the X-ray equipment.

The skin dose levels in normal use may be high enough to cause deterministic effects. The availability of the different settings has a considerable effect on the radiation quality, the delivered dose rate and the image quality.

Although Precision MPi is designed and constructed to meet high standards of safety and efficiency, and poses no unique radiation safety problems, operators are reminded of the need for diligence in the observation of radiation safety practices. For this reason, the following rules should be strictly observed:

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- Use the smallest possible fluoroscopic field. The intensity of scatter radiation is highly dependent on the volume of the irradiated body.

- Use the shortest possible fluoroscopy time. The radiation load increases in proportion to the fluoroscopy time. It is advisable to switch fluoroscopy on for short periods at a time; this appreciably reduces the total radiation dose.

- Keep as far away from the primary beam as possible. Distance is the best protection against radiation. Take care to keep as far away as possible from the patient being irradiated and the x-ray source. In the case of radiography, keep at least 1.5 m away from the patient being irradiated. Placing a hand or other part of the body in the direct beam should also be avoided.

- X-ray should be disabled whenever there is no procedure in progress to prevent the possibility of radiation being emitted through the inadvertent actuation of an irradiation switch. This is done on the generator touch screen by pressing the X-ray lock button .
  In case of obvious X-Ray emission (audible tone and/or red light signal on) without image on the live monitor, the user shall perform the following actions:
  • First, to release the footswitch/handswitch.

  • Second, if X-Ray are still emitted, to Press ○ on the generator touch screen to switch the generator off.

  • Third, if X-Ray are still emitted, to switch off the power in the technical area.

- Take protective measures to safeguard against scatter radiation. Scatter radiation is caused by any object in the path of the primary beam and may be of equal or less intensity than the primary beam that exposes the film.

- Use lead aprons. Always wear protective clothing. Lead aprons with a lead-equivalent value of 0.35 mm attenuate 50 kV X-rays by 97 % and 100 kV X-rays by 90 %.

- Use film badges/dosimeters for personnel monitoring during operation and maintenance of the system. It is advisable to determine the radiation dose per person under practical conditions in the space where the unit is to be used, and to use this value as a basis for determining the radiation safety measures to be taken.

2.3.1.1 Skin Dose Levels

The skin dose levels in normal use may be high enough to cause deterministic effects. The availability of the different settings has a considerable effect on the radiation quality, the delivered dose rate and the image quality.

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2.3.1.2 Available Settings

Protection against Ionizing Radiation Hazards and Range of technical factors
Voltage range:
40 - 150 kVp ± 10%
Current range
0.5 – 1000 mA peak ± 20% + 1 mA

The skin dose level in normal use may be high enough to cause deterministic effects. The availability of the different settings has a considerable effect on the radiation quality, the delivered dose rate and the image quality.

Available configurations		
Available settings	**Radioscopy**	**Radiography**
Orientation of the X-ray beam	Movements of the positioner, see Chapter 3.3	
Patient support	In	
Anti-scatter grid	In or out	
Field of view	36 cm (nominal), 29 cm, 22 cm, 16 cm (14.2 in (nominal) 11.4 in, 8.7 in 6.3 in) 29 cm (nominal), 22 cm, 16 cm, 12 cm, 12 cm (11.4 in (nominal) 8.7 in, 6.3 in, 4.7 in)	

Operating settings		
Available settings	**Radioscopy**	**Radiography**
Technical details of parameters included in each mode of operation	Selected kV: 40 – 150 kV	Selected kV: 45 – 125 kV
	mA: 0.5 – 20 mA	mA: 1 – 1000 mA
Frame rates	30 fps, 15 fps, 7.5 fps, 3.75 fps	
Selectable added filters automatically applied	Without additional filters or 1mm Al + 0.1 mm Cu or 1 mm Al + 0.2 mm Cu or 2 mm Al	Without additional filters or 1mm Al + 0.1 mm Cu or 1 mm Al + 0.2 mm Cu or 2 mm Al

Geometry		
Available settings	**Radioscopy**	**Radiography**
Source to Image Distance (SID)	104 – 128 cm ± 1% (40.9 – 50.4 in ± 1%)	
Modes of operations	Normal or High	Normal
Default mode	Normal	Normal
Loading factors, when mode is selected	45 – 125 kV	40 – 140 kV
	mA: 0.5 – 20 mA	mA: 1 – 1000 mA
Highest reference dose 30 cm (11.8 in) from the image receptor	Dose limits: Normal: < 10 R/min High Level Fluoro: < 20 R/min	

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Typical set of values in cardiac procedures		
Available settings	**Radioscopy**	**Radiography**
Diagnostic	Normal	Normal
Interventional	Normal	Normal

2.3.1.3 Radiation data

2.3.1.3.1 Procedure for measuring dose rate

Available settings	Radioscopy	Radiography
Orientation of X-ray beam	Horizontal	
Patient support	Out	
Anti scatter grid	Out	
Field of view	40 cm (15.8 in)	
Port blocker	In	Out
Operating settings		
Frame rate	30 fps, 15 fps, 7.5 fps, 3.75 fps	
Selectable added filters	None	None
Geometry		
Source to image distance	104 cm (40.9 in)	104 cm (40.9 in)
Distance of focal spot to measuring probe	74 cm (29.1 in)	74 cm (29.1 in)
X-ray field size at the measuring probe	28 cm / 22 cm (11 in / 8.7 in)	28 cm / 22 cm (11 in / 8.7 in)
Phantom	None	

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2.3.1.3.2 Test results from a factory test:

	kV	Continous	3 PPS	7.5 PPS	15PPS	30 PPS
Mag 0	45	1.204 R/min	231.6 mR/min	537.3 mR/min	1.153 R/min	2.275 R/min
	60	2.544 R/min	525.4 mR/min	1.221 R/min	2.601 R/min	5.166 R/min
	78	4.663 R/min	992.6 mR/min	2.309 R/min	4.924 R/min	9.452 R/min
	100	6.781 R/min	1.527 R/min	4.081 R/min	7.565 R/min	
	110	8.208 R/min	1.839 R/min	4.289 R/min	9.151 R/min	
	125	8.406 R/min	2.380 R/min	5.542 R/min	9.258 R/min	
Mag 1	45	1.192 R/min	231.5 mR/min	538.5 mR/min	1.151 R/min	2.290 R/min
	60	2.513 R/min	513.0 mR/min	1.209 R/min	1.680 R/min	4.816 R/min
	78	4.593 R/min	987.0 mR/min	2.295 R/min	4.907 R/min	9.489 R/min
	100	6.993 R/min	1.533 R/min	3.583 R/min	7.638 R/min	
	110	8.276 R/min	1.853 R/min	4.960 R/min	9.224 R/min	
	125	8.471 R/min	2.373 R/min	5.900 R/min		
Mag 2	45	1.181 R/min	229.0 mR/min	532.2 mR/min	1.132 R/min	2.247 R/min
	60	2.488 R/min	505.9 mR/min	1.192 R/min	2.543 R/min	4.976 R/min
	78	4.548 R/min	973.8 mR/min	2.270 R/min	4.835 R/min	9.428 R/min
	100	6.927 R/min	1.534 R/min	3.574 R/min	7.603 R/min	
	110	8.186 R/min	1.845 R/min	4.305 R/min	9.160 R/min	
	125	8.383 R/min	2.361 R/min	5.808 R/min		
Mag 3	45	1.171 R/min	226.8 mR/min	529.0 mR/min	1.129 R/min	2.238 R/min
	60	2.467 R/min	503.2 mR/min	1.173 R/min	2.527 R/min	4.995 R/min
	78	4.507 R/min	971.1 mR/min	2.250 R/min	4.793 R/min	9.497 R/min
	100	6.859 R/min	1.524 R/min	3.539 R/min	7.545 R/min	
	110	8.116 R/min	1.840 R/min	4.279 R/min	9.096 R/min	
	125	8.308 R/min	2.347 R/min	5.834 R/min		

kV	Continuos	3 PPS	7.5 PPS	15 PPS	30 PPS	KV	HLF
123	9.312 R/min					125	17.87 R/min
125		2.340 R/min				125	17.89 R/min
125			6.583 R/min			125	17.90 R/min
110				9.440 R/min		125	17.90 R/min
80					9.325 R/min	125	17.91 R/min

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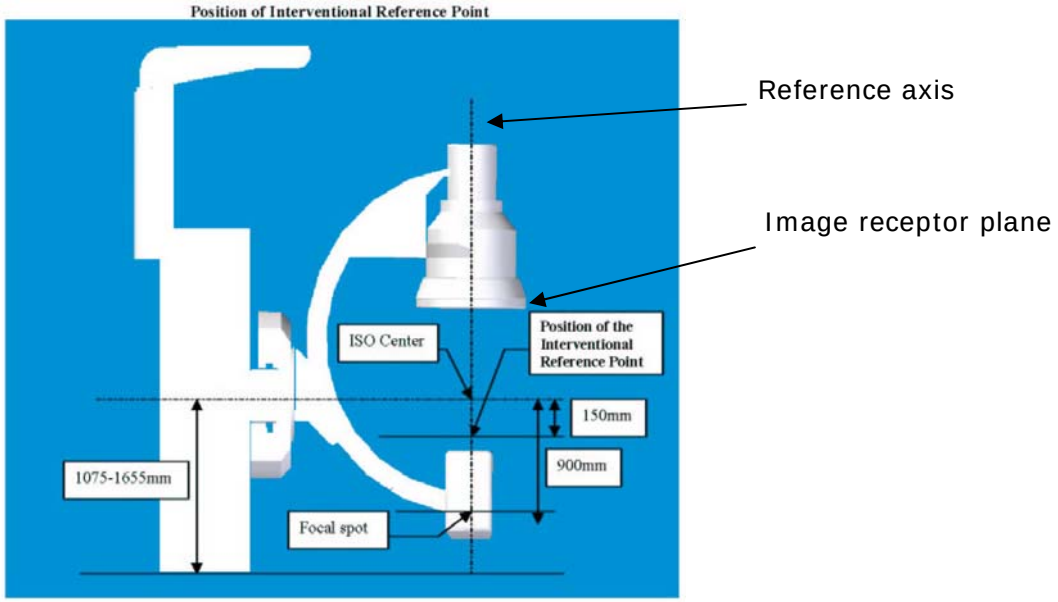
2.3.1.4 Reference axis

The X-ray tube and the image intensifier is mounted on a C-arc, thus only a single reference axis is present on the system.



2.3.1.5 Concept of Intervention Reference Point

The INTERVENTIONAL REFERENCE POINT is intended to be representative of the point of intersection of the X-ray beam axis with the patient. For GE Precision MPi including an isocenter, the INTERVENTIONAL REFERENCE POINT is the point on the reference axis 15 cm (5.9 in) from the isocenter towards the focal spot.

This distance is assumed to represent a good approximation of the value of the actual focal spot to skin distance during interventional procedures. If one considers currently available methods to estimate absorbed doses to selected tissues for radioscopic and cine-angiographic examinations of the coronary arteries of adults, these methods rely on the use of distinct operating conditions commonly used in radiological examinations of the heart.

These operating conditions are associated with a view, an arterial projection, and technique factors on the X-Ray equipment such as the X-Ray tube voltage (kV), the half value layer (HVL), and the focal spot to skin distance, the focal spot to image receptor distance and the entrance field size.

A review of the operating conditions derived from analyses of practice indicates that the defined interventional reference point is, in fact, a fair approximation of the focal spot to skin distance for each field. Unfortunately, similar data are not available for non-cardiac diagnostic and interventional procedures.

The error in estimating the total absorbed dose to the skin introduced from the defined interventional reference point should average out as long as the interventional procedure is composed of multiple views. When the interventional procedure is limited to one or a few views, the possibility of error in estimating the absorbed dose to the skin may be higher. However, even under worst-case conditions, errors should be less than a factor of two.

Of course, assessing the position of the patient and calculating the appropriate correction factor can eliminate most of this error.

2.3.1.6 Air Kerma Maps

The following Air kerma Maps are representing the dose values in the vicinity of the equipment. Measurements have been conducted in accordance to IEC 60601-2-43 annex FF.

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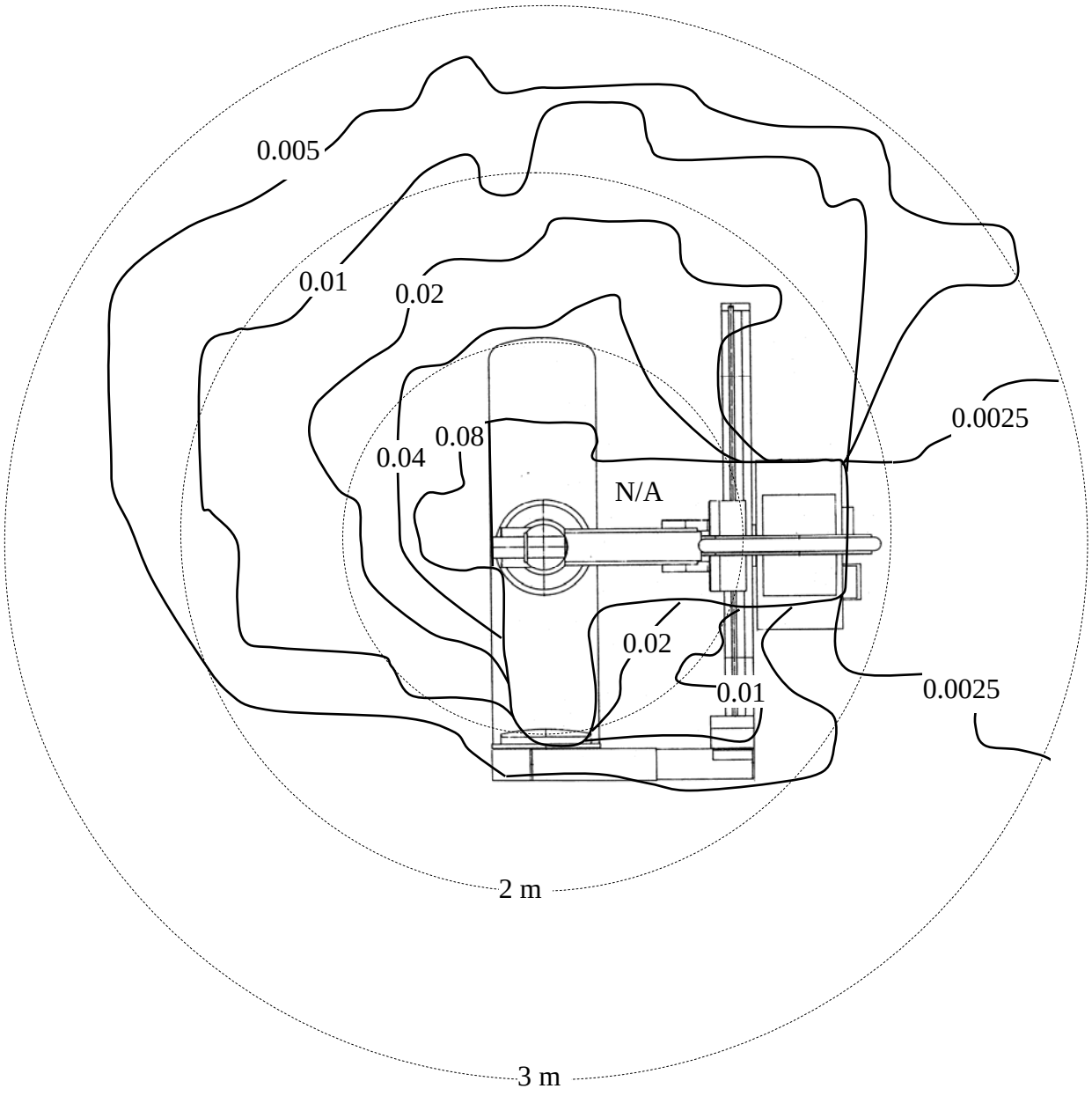
2.3.1.6.1 Vertical beam 100 cm (39.4 in) above the floor



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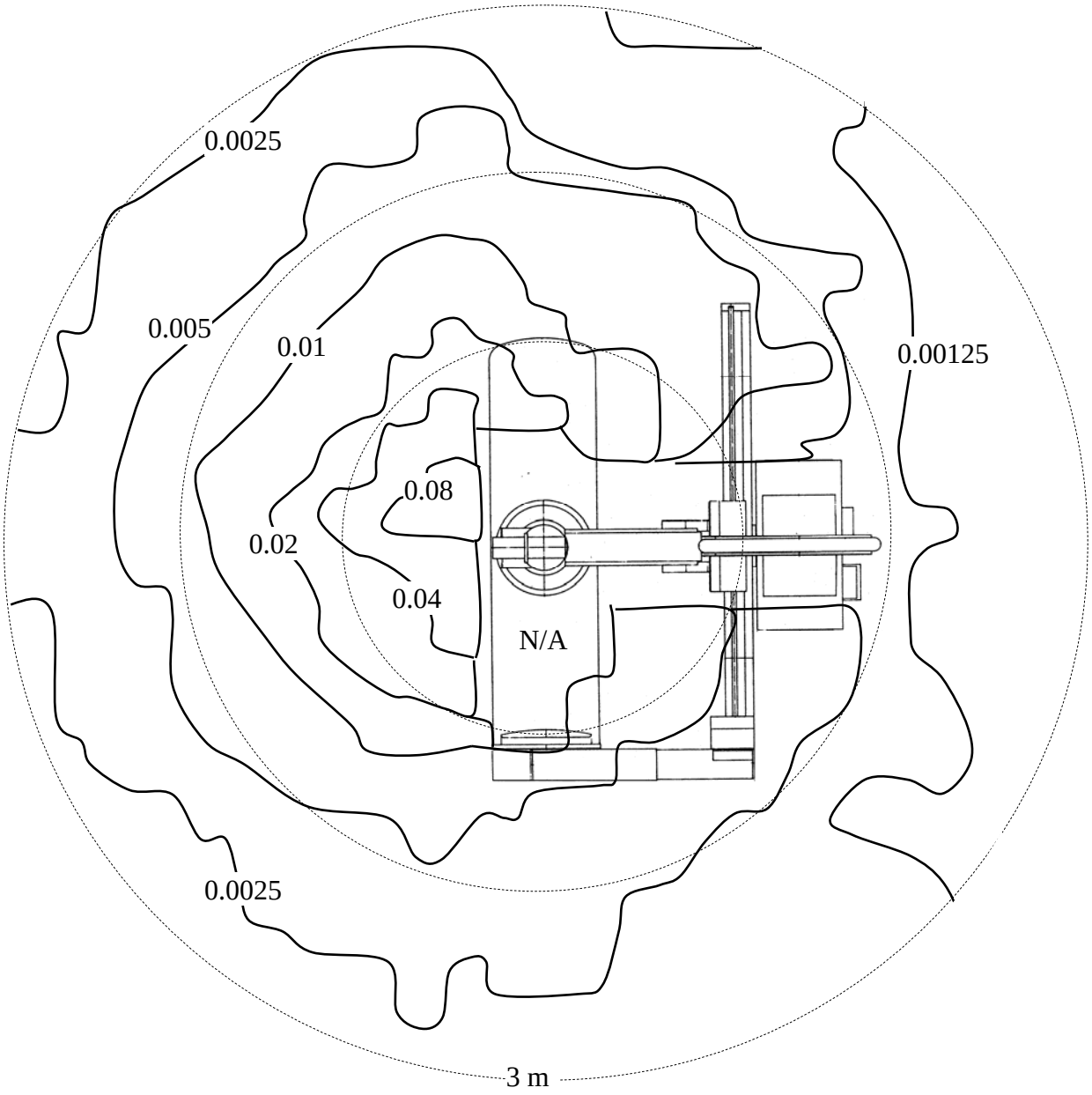
2.3.1.6.2 Vertical beam 150 cm (59.1 in) above the floor



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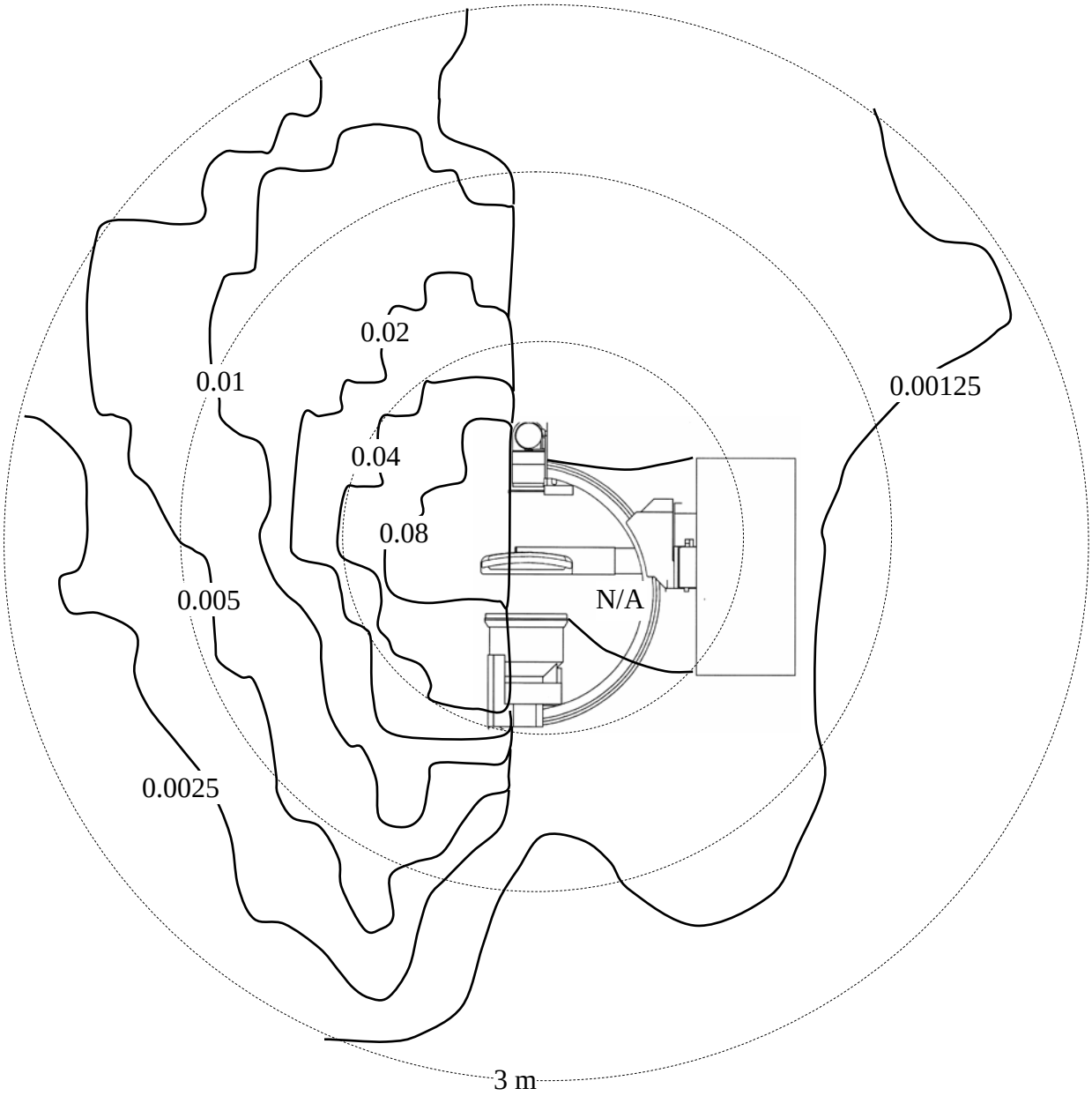
2.3.1.6.3 Horizontal beam 100 cm (39.4 in) above the floor



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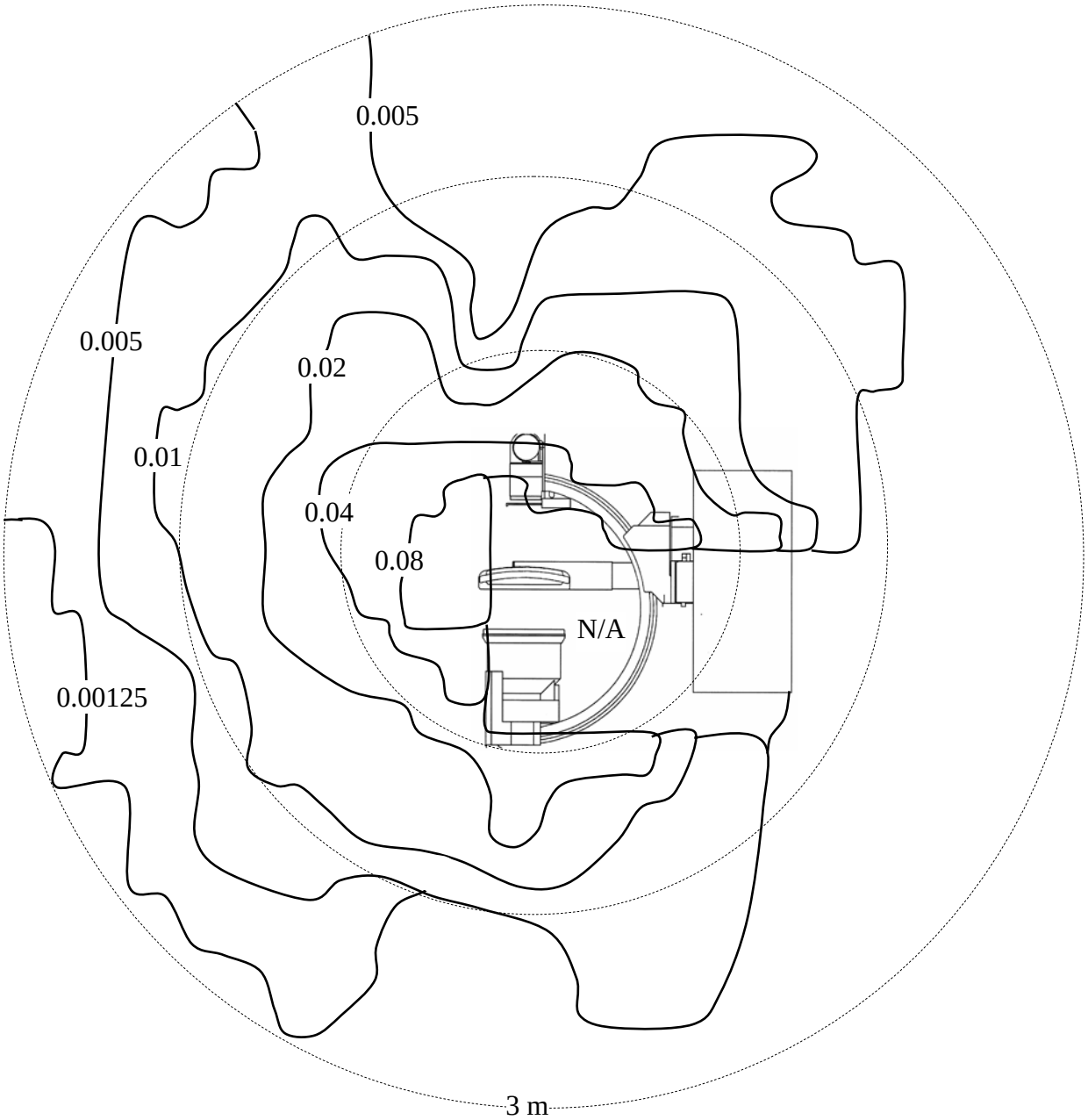
2.3.1.6.4 Horizontal beam 150 cm (59.1 in) above the floor



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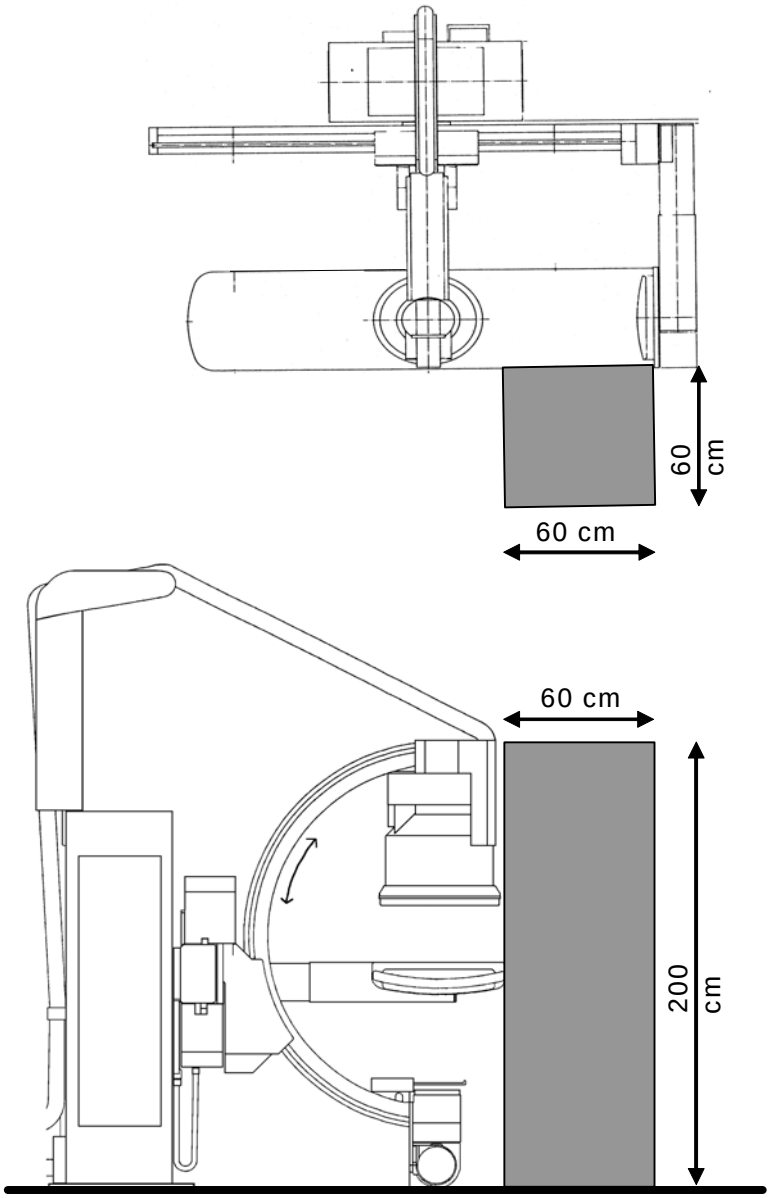
2.3.1.7 Significant Zone of Occupancy

The significant zone of occupancy described in this section is intended to be used during radioscopically interventional guided procedures.



NOTE: Being in the significant zone of occupancy, does not free Physician/Operator from using protective device as described in Chapter 2.3.1

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2.3.1.8 Dosimetric Calibration

All dosimetric calibration should only be performed by service personnel from GE Medical Systems or NRT-Nordisk Røntgen Teknik A/S during regular service maintenance as described in the service maintenance plan in the technical manual.

2.3.1.9 Filters

The GE Precision MPi features extra filters in the collimator to be inserted between the X-ray tube source and the patient in order to harden the beam and reduce the soft radiation. The harder the beam, the better the penetration of the anatomy allowing the X-ray photons to exit the patient and reach the digital detector. The filters also absorb the softer radiation so that it never reaches the patient and keeps the skin dose radiation and absorbed dose to a minimum.

2.3.1.9.1 Spectral filtration

The collimator (beam limiting device) features 3 additional filters of:
1 mm Al + 0.1 mm Cu – corresponds 7.5 mm Al Equivalence
1 mm Al + 0.2 mm Cu – corresponds to 10.6 mm Al Equivalence
2 mm Al + 0 mm Cu – corresponds to 2 mm Al Equivalence
Aluminium equivalence determined at 70 kV
The GE Precision MPi has automatic spectral filtration that appropriately inserts any of the 3 spectral filters or no spectral filtration into image. This is programmed via the APR-settings as described in chapter 12 on Preparing and editing the APR.

2.3.1.9.2 Vascular filters

The collimator is equipped with two vascular filters that can be turned in any direction. The filters are made from 5 mm Al + 0.4 mm Cu which corresponds to 21 mm Al equivalence.
See description of the control buttons in chapter 5.4.2 of this manual.

2.3.1.9.3 Strip filter

The collimator is equipped with a long strip filter which can be used during examination of extremities instead of or in addition to physical filters. The filter can be turned in any direction and is made from 2 mm Al + 1.2 mm Cu which corresponds to 32 mm Al equivalence.

2.3.1.10 Patient Table

The material from which the tabletop is constructed is also significant for the required dose, because the patient table is penetrated by the radiation and weakens it before it reaches the image intensifier. Therefore, if at all possible the patient table should not contain any material that strongly weakens the radiation or absorbs it well, such as lead or metals in general. Carbon fibre has proven to be the best material for X-ray system patient tables because its radiation absorption is minimal and the patient table can take a great amount of stress. The radiation absorption of the GE Precision MPi patient table is less than 1.5 mm Aluminium at 70 kV.

2.3.1.11 Image Intensifier Cover

The removable gray cover on the Image Intensifier Touchguard has radiation absorption less than 1.2 mm Aluminium at 70 kV.

2.3.1.12 Collimation

The size of the radiation field will always be visible on the image monitors as the collimator calibration is set always to make the collimator blades visible regardless of the technique and magnification used.
See description of the collimator control buttons in chapter 5.4.2 of this manual.

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2.3.1.13 How to Reduce Radiation Exposure Dose

- **Radiation Time**
  In Fluoro: maintain a precise record of fluoroscopy times in a single location; when possible change the entry point of the beam in order to reduce local dose.
  In Record: try to keep the frame rate at the lowest value compatible with medical requirements; minimize the total sequence.
- **Duration**
  When the tube is positioned under the table the patient helps protect the staff.
  Additional lead aprons and protective devices such as lead gloves, glasses and thyroid shields are also effective in limiting occupational exposure dose.
- Maximize the distance between the patient and the x-ray tube (focal spot to skin distance) to keep the absorbed dose to the patient as low as reasonably achievable.
- Minimize the distance between the patient and the Image Receptor
- Collimate
- Use Low fluoro detail whenever possible
- Acquisition at a minimum of 85 kV whenever possible
- Remove grid – see chapter 3.4

2.3.1.14 Door switch

It is recommended that a door switch with the function as an irradiation disabling switch is installed and used at all times except when a procedure is in progress. This is to prevent radiation from being emitted through the inadvertent actuation of an irradiation switch.
Should the door open during irradiation, the procedure continues but when the foot switch or hand switch is no longer activated, renewed actuation is not possible until the door is locked again.

2.3.1.15 Fluoro Warning

After 5 min. accumulated fluoro exposure the generator touchscreen will give an audible tone and a message on the touchscreen stating ‘Fluoro timer warning level exceeded’. The fluoro interval timer is set to give this warning every 5 min. To remove this warning, reset the fluoro timer (see chapter 5.4.1.3).
Systems configured for the European countries will be set to terminate exposure in the event of loading in continuous mode having continued without interruption for a period exceeding 10 min.

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2.3.2 PROTECTION AGAINST CONTAMINATION / INFECTION / ALLERGY / TOXICITY HAZARDS

In order to prevent any patient contamination and according the local regulation, after each procedure, always clean parts of the equipment, which were in contact with the patient (patient table, mattress, image intensifier) with a bactericidal, germicidal and antiviral solution.
Check the solution used is also active against HIV virus and hepatitis B virus.

2.3.2.1 General Information

Adequate cleaning and disinfection is necessary to prevent disease transmission. Be sure to thoroughly clean and disinfect equipment surfaces that contact the patient and all equipment surfaces likely to become soiled during use.
Improper cleaning methods or the use of certain cleaning and disinfecting agents can damage the equipment, cause poor imaging performance or increase the risk of electric shock.
To avoid possible injury or equipment damage:

- Do not use harsh detergents, abrasive cleaners, high alcohol concentration or Methanol at any concentration.
- Do not expose equipment parts to steam or high temperature sterilization.
- Never allow liquids to enter the internal parts of the equipment. Do not apply cleaning sprays or liquids directly to the equipment; always use a clean cloth dampened with the spray or liquid. If you become aware of liquid entry, disconnect the electrical supply and have the equipment checked by qualified service personnel before returning it to use.

2.3.2.2 Equipment Cleaning Instructions

Patient contact surfaces should be washed with mild soap in lukewarm water. Equipment parts that enclose electrical components must not be immersed but rather cleaned with a soft dampened cloth, taking care not to allow liquids to enter the equipment. Surfaces should be scrubbed as needed using a soft sponge, gauze or cloth to remove all visible residues. Scrubbing with a soft bristle brush (such as a toothbrush) may be necessary to reach corners or to remove material that has dried onto the surface.
Subsequent disinfection may not be effective if the surfaces are not thoroughly clean. Rinse all surfaces with clean water to remove visible soap residue, taking care to avoid liquid entry to internal equipment parts. Dry surfaces with a soft cloth to remove any visible residues.

2.3.2.3 Disinfection

Patient contact surfaces may be disinfected with suitable liquid chemical germicide, bactericide and antiviral. Surfaces must first be cleaned of all visible contamination (see above). The disinfecting liquid must have a minimum contact time with the surface to be effective. Equipment parts should be wiped with a wet cloth or sponge as directed by the instructions for use provided with the disinfecting liquid. Further rinsing or wiping with clear water and drying with a soft cloth should be done to remove any disinfecting liquid residue that may remain. Take care to avoid liquid entry to internal equipment parts.

2.3.2.4 High Level Disinfection

In the event that you feel a high level disinfection is necessary due to equipment contact with broken skin, or being used with infected or immune compromised patients, the same patient contact surfaces may be high level disinfected with a liquid chemical germicide rated for high-level disinfections. The same process used as that for intermediate level disinfections is generally followed; however, the time of contact is usually much longer for high-level disinfections.

2.3.2.5 Recommended Cleaning Agents

• Soap with lukewarm water.

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2.3.2.6 List of Disinfecting Agents

The following legally marked products have been used on GE equipment without causing equipment damage.

- SURFANIOS (ANIOS Labs)
- TASKI DS 5001 (Diverseylever Labs)
- ARGOCIDE Formule 2000 (ARGOS Labs)

Use one of these disinfecting agents or other equivalent agent.

2.3.2.7 Guidance for the Use of the Cleaning and Disinfecting Agents Listed

Always follow the cleaning and disinfecting agents manufacturer's instructions and precautions for mixing, storage, method of application, contact time, rinsing requirements, protective clothing, shelf life and disposal to help assure effective and safe use of the product.

2.3.2.8 Flammable Gasses

Do not use equipment in the presence of flammable gasses.

2.3.2.9 Use of Protective Devices and Accessories

There is a need to use protective drapes on parts of the equipment or its accessories to protect from infection/contamination.

Use protective clothing and accessories to minimize radiation whenever possible, such as lead aprons, shields and glasses.

Always use protective (sterile) drapes during radioscopically guided interventional procedures in order to avoid fluids dripping on the equipment, such as image intensifier, injector, X-ray tube and control panels.

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2.3.3 ELECTRICAL SAFETY

WARNING: Do not remove covers or cables from the system. High electrical voltages are present within this system. Removing covers or cables could lead to serious or fatal personal injury.

WARNING: High voltages capable of causing death are present within this equipment. Refer all servicing to qualified service personnel only.

WARNING: Do not attempt to renew any batteries in the system!

The user must always electrically disconnect system from mains before cleaning or disinfecting it.

Do not allow water or other liquid to enter the system as they may cause short-circuits and/or corrosion. It must be noted that some disinfectants vaporize, forming potentially explosive mixtures. Should such disinfectants be used, the vapors must first be allowed to disperse before the system is returned to use.

2.3.3.1 Equipotential ground connection

Precision MPi must be used only in procedure rooms that comply with all relevant legislation and recommendations concerning electrical safety in rooms and other operating spaces used for medical purposes such as US National Electrical Code or IEC Standards - see Applicable Standards later in this chapter. These give provisions for a protective (ground) terminal used for equipotential connection.
Additional equipment, such as an injector must also be connected to the protective ground (earth) terminal.

2.3.3.2 Radio frequency energy

This equipment generates, uses, and can radiate radio frequency energy. The equipment may cause radio frequency interference to other medical and non-medical devices and radio communications. To provide reasonable protection against such interference, this product complies with emission limits for Group 1 Class A Medical Devices as stated in EN 60601-1-2 edition 1 (1993) and edition 2 (2001).

However, there is no guarantee that interference will not occur in a particular installation. If this equipment is found to cause interference (which may be determined by switching the equipment on and off), the user (or qualified service personnel) should attempt to correct the problem using one or more of the following measures:
• Reorientate or relocate the affected device(s).
• Increase the distance separating the affected device from the equipment.
• Power the equipment from a source different from that of the affected device.
• Consult the point of purchase or the service representative for further suggestions.

The manufacturer is not responsible for any interference caused either by the use of interconnects cables other than those recommended or by unauthorized changes or modifications to this equipment.
Unauthorized changes or modifications could void the user's authority to operate the equipment.

Do not use devices that intentionally transmit RF Signals (Cellular Phones, Transceivers, or

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Radio Controlled Products) in the vicinity of this equipment as it may cause performance outside the published specifications. Keep the power to these types of devices turned off when near this equipment. The medical staff in charge of this equipment is required to instruct technicians, patients, and other people who may be around this equipment to fully comply with the above requirement.

High levels of radio frequency (RF) energy in the vicinity of this x-ray suite may cause noise to appear on video monitors and recorders. This noise should disappear spontaneously when the stimulus is removed. If the problem persists, call service.

Under certain electrostatic discharge (ESD) and electrical fast transit (EFT) conditions, noise may appear on video monitors and recorders. This noise should disappear spontaneously when the stimulus is removed. If the problem persists, call service.

Us federal law restricts this device to be used by or on the order of a physician.

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2.3.4 EXPLOSION SAFETY

WARNING: It is not safe to operate this system in the presence of potentially explosive or inflammable vapor, gas, or aerosols, since this could cause fatal or other serious personal injury and/or damage to the system.

In this context, it must be remembered that certain disinfectants can constitute such a hazard. Before using such substances in the room where this system is installed, the system must be switched off and allowed to cool down, then covered with suitable material which will prevent the ingress of vapor, gas, aerosol, or liquid.

Never operate this system in areas where there is a risk of an explosive atmosphere, including flammable anaesthetic mixture with air or with oxygen or nitrous oxide. Detergents and disinfectants, including those used on patients, may create explosive mixtures of gases. Please observe the relevant regulations. Failure to comply could result in fire and explosion.

Before switching ON the system after the use of such substances, ensure that all traces of them have dispersed.

2.3.5 MECHANICAL SAFETY

Due care must be taken to prevent injury to either patient or operating personnel.
Ensure that clothing or drapes (coverings) are not and cannot be trapped by any part of the system.

WARNING: Power signal to the motor relays is supplied through a 0-relay to prevent unintended movements of the systems. Failure on the 0-relay is detected at start-up and for that reason the system has to be restarted at the end of each sequence

WARNING: The use of accessories fixed to the carbon fibre patient table involves the risk of collision with the image intensifier, so therefore the operator must be very attentive to this fact when operating the Precision MPi.

WARNING: Do not remove covers from the system. Removing covers could lead to serious or fatal personal injury.

WARNING: If the cover plate has been removed from the Image Intensifier touchguard in order to remove the grid, do not operate the equipment until the cover has been attached again. Operating the system without the cover could cause serious or fatal personal injury.

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2.3.6 FIRE SAFETY

WARNING: Use only extinguishers on electrical or chemical fires which are specifically labeled for those purposes. Using water or other liquids on an electrical fire can lead to fatal or other serious personal injury.

Use of electrical equipment in an environment for which it was not designed can lead to fire or explosion.

Fire regulations for the type of medical area being used should be fully applied, observed and enforced. Fire extinguishers should be provided for both electrical an non-electrical fires.

All operators of this medical electrical equipment should be fully aware of and trained in the use of fire extinguishers and other fire-fighting equipment, and in local fire procedures.

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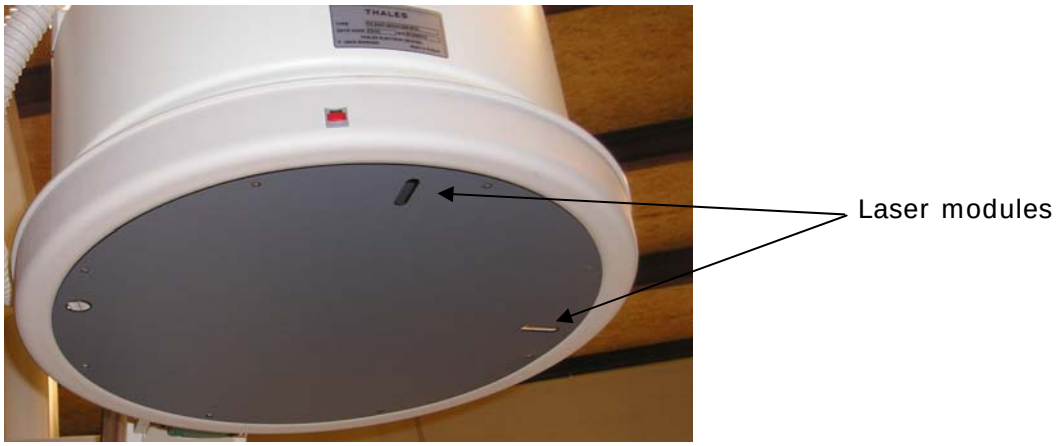
2.3.7 LASER LIGHT RADIATION SAFETY

The laser light option of Precision MPi should only be used under supervision of a medically trained person with knowledge of the hazards implied by the use of laser light. It is the user's responsibility to fulfill the local safety regulations regarding laser light radiation.

LASER CROSS HAIRS, SAFETY PRECAUTIONS

CLASS 1 LASER PRODUCT
DO NOT STARE DIRECTLY INTO THE BEAM

The Laser Cross Hairs are provided through activation of the two laser modules mounted inside the Laser Touch guard as shown in the picture below.
Be careful not to touch the laser modules, as the quality of the laser beam and the resulting laser cross is depending on the calibration of the laser modules and clear and uncontaminated glass lenses. Refer to the Maintenance section in the Technical Manual for adjustment and replacement.



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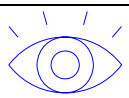
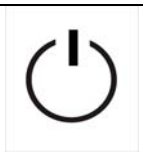
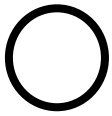
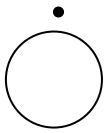
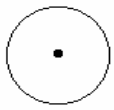
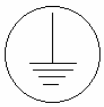
2.4 SAFETY / WARNING SYMBOLS

	Radiation exposure symbol used on operator console. Lights to indicate that an exposure is in progress. This is accompanied by an audible tone from the console.
	Fluoro radiation exposure symbol used on the touch screen and on optional remote fluoro control unit. Lights to indicate that a fluoro exposure is in progress. This is accompanied by an audible tone from the console.
	This symbol indicates the system is rated as Type B Equipment according to IEC 601 regulations. This symbol is located on the rear panel of the cabinet.
	Indicates the power switch for the digital imaging system. The symbol is located on the front panel of the electronics cabinet.
	Power: Disconnection from the mains
	ON - Power: connection to the mains
	OFF – Only for part of the equipment
	ON–Only for part of the equipment
	Protective Earth Symbol
	Alternating Current (AC)

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2.5 APPLICABLE STANDARDS

Interventional X-ray equipment GE Precision MPi IEC 60601-2-43:2000
Interventional X-ray equipment GE Precision MPi with radiation in accordance with IEC 601-1-3:1994

- FDA 510(K)
- UL 60601-1 (Underwriters Laboratories)
- FCC (Federal Communications Commission)
- IEC 60601-1 (International Electro-technical Commission)
- IEC 60601-1-3 (International Electro-technical Commission)
- IEC 60601-2-32 (International Electro-technical Commission)
- IEC 60601-2-43(International Electro-technical Commission)
- EC Directive 93/42/EEC concerning Medical Devices (European Community), CD-mark
- CAN/CSA C22.2 No. 601.1

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2.5.1 LABELING

The following are examples of labels on the system:

Marking plate located at the rear side of the Positioner.

INTERVENTIONAL X-RAY EQUIPMENT **GE PRECISION MPi** IEC 60601-2-43:2000	
GE PRECISION MPi SN	507006
POSITIONER SN	505004
COUNTRY OF ORIGIN	DENMARK
MANUFACTURED	JANUARY 2004
EQUIPMENT TYPE	GE Precision MPi, Eur.
NRT REF	02980000
CLASSIFICATION (60601-1)	CLASS 1, TYPE B
MODE OF OPERATION	20%, INTERMITTENT OPERATION; 2 MIN OPERATION, 8 MIN REST
INPUT VOLTAGE	230VAC , 16A
FREQUENCY	50/60 Hz
MAX CURRENT	10A
DISTRIBUTED BY: GE MEDICAL SYSTEMS	
This system complies with applicable radiation standards in FDA 21 CFR subchapter J, at date of manufacture.	
	GE Precision MPi WITH RESPECT TO ELECTRICAL SHOCK, FIRE AND MECHANICAL HAZARDS ONLY, IN ACCORDANCE WITH UL 60601-1, CAN/CSA C22.2 No. 601.1 IEC 60601-1-3, IEC60601-2-43
	MANUFACTURER: NRT-NORDISK ROENTGEN TEKNIK A/S BIRKEGAARDSVEJ 16 DK-8361 HASSELAGER DENMARK

The following label or similar is attached to the patient table and restricts the table load capacity to a maximum of 450 lbs (205 kg) or 360 lbs (162 kg), equally distributed.

	WARNING **Configuration for CPR:** **Move the Table Top to the horizontal position and place the CPR Support under the head end as shown.** **For more information see accompanying documents.**		**Aluminum equivalent for Table top < 1.5 mm** **Maximum table load capacity 450 lbs (205 kg)**	**Date of manufacture: March 2004** **Manufactured by: NRT-Nordisk Roentgen Teknik A/S** **Country of origin: Denmark**

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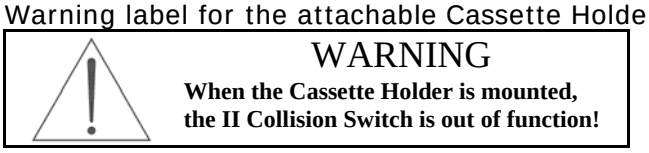
Warning label for the attachable Cassette Holder (optional accessory):



2.5.2 ELECTROMAGNETIC COMPATIBILITY (EMC)

In accordance with the intended use, this X-ray system complies with the European Council Directive concerning Medical Devices. The CE marking affixed to this product signifies this. One of the harmonized standards of this Directive defines the permitted levels of electromagnetic emission from this equipment and its required immunity from the electromagnetic emissions of other devices.

CAUTION: Medical Electrical Equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the Accompanying Documents.
Portable and mobile RF communications equipment can affect Medical Electrical Equipment.

CAUTION: It is not possible, however, to exclude with absolute certainty the possibility that other high frequency electronic equipment, which is fully compliant to the EMC regulations, will not adversely affect the operation of the generator of the system. If the other equipment has a comparatively high level of transmission power and is in close proximity to the generator, these EMC concerns (the risk of interference) may be more pronounced. It is therefore recommended that the operation of equipment of this type such as mobile telephones, cordless microphones and other similar mobile radio equipment be restricted from the vicinity of this X-ray system.

CAUTION: During installation of the system, care must be taken to prevent the potential risk of electromagnetic interference between this equipment and other devices. The system has been tested for EMC compliance, but interference can still occur in an electromagnetically noisy environment. Attempt to maintain a suitable distance between electrical devices to prevent cross-interference.

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2.5.3 EQUIPMENT DATA

GENERATOR:

kVp range:	Radiography 40 to 140 kVp Fluoroscopy 40 to 125 kVp
kVp accuracy:	± (5% + 1) kVp
mA range:	Radiography 10 to 1000 Ma (100 kW), Conventional Fluoroscopy 0.5 to 6.0 mA High Level Fluoroscopy 5.0 to 20 mA Pulsed Fluoro 10 mA to 20 mA
mA accuracy:	± (5% +1.0) mA for mA values 25 mA - 1000 mA
mAs range:	Tube dependent, max 1000 mAs
Time range:	Radiography 1.0 to 6300 ms Fluoroscopy 0 to 5 or 0 to 10 minutes
Lowest current - time product:	0.5 mAs

LOADING FACTORS:

Generator: Loading factors which will allow lowest current - time product:	All mA values < 250 mA. Refer to table 1 in Appendix A
Loading factors corresponding to the maximum specified energy in one hour (Maximum Continuous Heat Dissipation)	X-ray tube G1092 with B160 housing: 70 kV and 2.85 mA
Loading factors corresponding to the maximum specified energy in one hour (Loading in Intermittent Mode)	X-ray tube G1592 with B180 housing and HE320/321 heat exchanger: 150 kV and 7 mA

POSITIONER ENVIRONMENTAL CONDITIONS:

Transport and storage:

Ambient temperature range:	0-40°C
Relative humidity:	0-90% RH, non-condensing
Atmospheric pressure:	700 – 1060 hPA, Altitude to 12000 m above sea level
Note:	Do not tilt the system during transportation

Operation:

Ambient temperature range:	10-40°C
Relative humidity:	30-75% RH
Atmospheric pressure:	700 – 1060 hPA, Altitude to 3000 m above sea level
Max. voltage/current in emergency stops:	24VDC/100mA SELV.
Source Image Intensifier Distance (SID)	102 - 125 cm (40.2 – 49.2 in)
Patient Table Dimensions	220 x 56 x 4 cm
Table Absorption factor	Approximately 1.0 Al-equivalent
Table Load capacity	450 lbs (205 kg) or 360 lbs (162 kg) equally distributed load (see label attached to the patient table)
Power requirements	Frequency: 50/60 Hz 230 V AC ± 10% 10A . External branch use: Bussmann KTN-R fuses 240 V, 16A or 115 V AC ± 10% 20A. External branch use: Bussmann KTN-R fuses 120 V, 32A.
Total weight of stand with x-ray tube and image intensifier	Approximately 3530 lbs (1600 kg)
Minimum ceiling height	275 cm (108.3 in)

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Address any questions regarding GE Precision MPi system operation to:

NRT-Nordisk Røntgen Teknik A/S
Birkegaardsvej 16
8361 Hasselager
Denmark

Telephone: +45 8628 3500

Fax: +45 8628 3088
Attention: Customer Support

E-mail: nrt@nrtxray.com
Attention: Customer Support

This manual was originally drafted, approved and supplied by NRT-Nordisk Røntgen Teknik A/S, Denmark in the English language.

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3.1 SWITCHING ON THE SYSTEM

WARNING: Maintenance and faults
Do not use the GE Precision MPi for any medical application unless you are certain that the daily maintenance programme has been satisfactorily completed and that the programme is up to date. See chapter 10 on Maintenance. If any part of the GE Precision MPi is known (or suspected) to be defective, do not use it until a repair has been made. Operation of the GE Precision MPi with defective components may expose the operator or a patient to radiation or other safety hazards. This could lead to fatal or other serious personal injury. It could also lead to clinical misdiagnosis.

WARNING: Operator knowledge
Do not operate the GE Precision MPi with patients unless you have a good understanding of its capabilities and functions. Using this equipment without such an understanding may compromise its effectiveness and/or reduce the safety of the patient, yourself and others.

Recommended sequence of switching on the system power:

1. Power on the positioner
2. Power on the generator
3. Power on the digital imaging system (DIS)

3.1.1 SWITCHING ON THE POSITIONER

To switch on the positioner power, turn the on/off switch on the rear of the positioner clockwise until a click is heard and 'on' is shown in the window of the switch.

NOTE: The system will not start if Emergency Stop on the left side of the positioner has been activated as described in Chapter 2.2.1 on Emergency Stop.
After pressing the Emergency Stop, the button must be pulled out again before starting up. After pulling it out, normal start up procedure can be continued.

The power on procedure is complete when the movements are shown on the positioner information monitor on the positioner. The start up takes about 25 seconds.

The Remote Touch Panel will power up automatically when the positioner is switched on.

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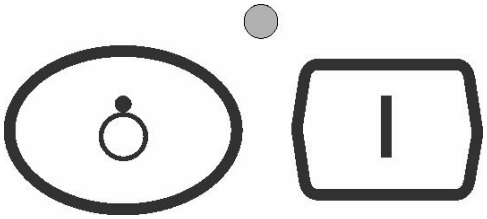
3.1.2 SWITCHING ON THE GENERATOR INCL. WARM-UP PROCEDURE

The generator is configured such that it is powered on when the touch screen is powered up.

The generator on / off buttons are located on the touch screen foot, below the touch screen display.



Press **I** to switch the X-ray generator on. The LED adjacent to the generator on / off switches will light when the generator is switched on. The touchscreen console will power up when the generator is switched on.

When the console has completed its startup routine after approximately 60 seconds, the main console menu will appear on the touch screen. The four menu selections are described below.

Touch screen main menu

The following selections appear on the touch screen console after the console is switched on, and when exiting out of manual / APR mode or system utilities mode.

- **MANUAL / APR MODE:** Press to select the normal console-operating mode. After a brief delay of approximately 15 seconds, buttons and indicators will appear on the touch screen, along with an anatomical graphic for APR selections or the kV/mAs stepping function will display, depending on configuration.

- **SYSTEM UTILITIES:** Press to enter the utilities menu (APR editor, language selection, APR backup / restore, sound control, date & time setup, touch screen calibration, receptor programming, etc). Refer to chapter 12 for details.

- **SYSTEM SHUTDOWN:** Press to shut down the console. A pop-up window will appear. Selecting **YES** will continue with system shutdown, **NO** will return to the main menu.

- **TUBE WARM UP**
  Press to start the X-ray tube warm-up routine. This routine can only be done when the Digital Imaging System (DIS) has been switched on and a patient is open (see chapter 4.1 on Working with Patient Files)

  The current date and time are displayed at the top of the main menu.

TUBE WARM UP PROCEDURE

CAUTION: The following procedure produces X-rays. Observe all safety precautions to protect personnel.

Use this procedure when the generator is first turned on for the day, or when it has not been used for several hours. This procedure provides for exposures at medium power before the tube is used at maximum mA or kV values. This will reduce stress on the X-ray tube.

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A semi-automatic X-ray tube warm-up procedure is available on the touch screen console. The following procedure is to be followed:

1. From the main console menu on the Generator Touchscreen, press TUBE WARMUP.
2. The Digital Imaging System must be switched on (see Chapter 3.1.3)
3. Select and open a patient (see Chapter 4.1)
4. Select Acquire from the Standard Control Box (see Chapter 5.4.6)
5. On the Generator Touch screen select the following:
    - 80 kV.
    - Large focal spot.
6. For a 200 - 300 kHU tube use approximately 160 mAs per exposure.
   For a 300 - 400 kHU tube use approximately 200 mAs per exposure.
   Depending on the X-ray tube power rating, select either 100 mA or 200 mA
7. Make the first exposure as directed.
8. The console will time a 30 second interval, and then allow the next exposure.
9. Perform the second and third exposures when permitted.
10. Select MAIN MENU to return to the main console menu. The system is now ready for use.

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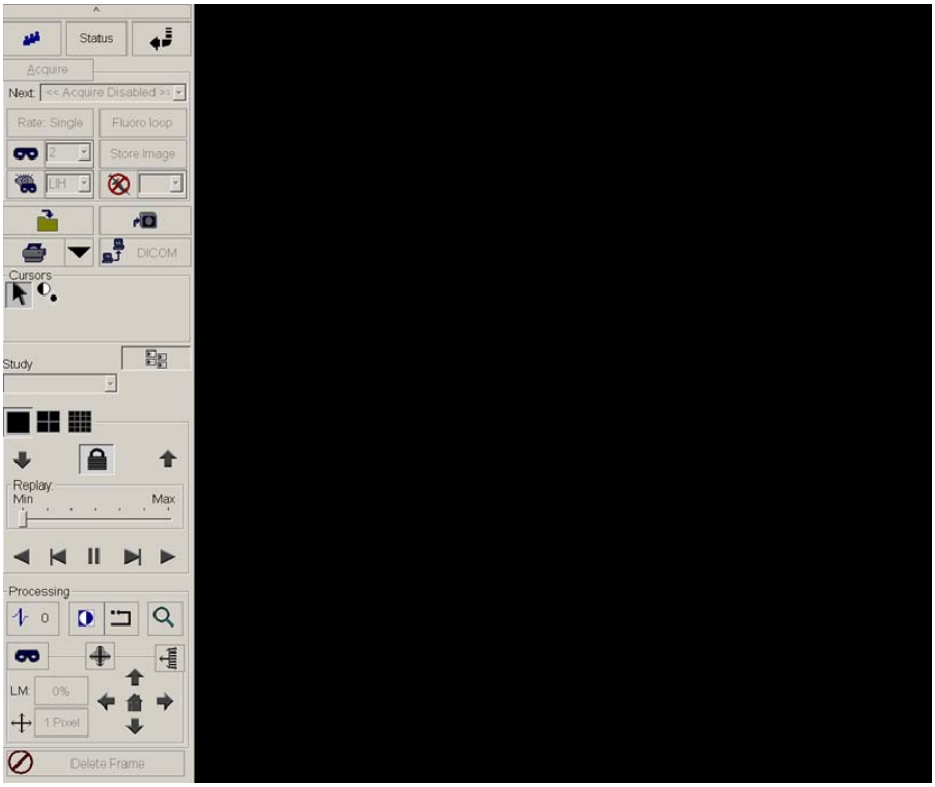
3.1.3 SWITCHING ON THE DIS

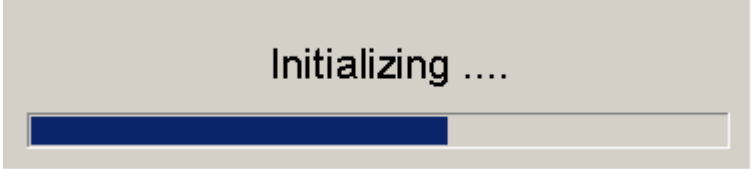
NOTE: DO NOT use the generator during the power-up cycle.

1. Turn ON the power for the x-ray generator as described above.
2. Turn ON the power for each of the DIS Monitors and other peripherals.
3. Turn ON the power for the DIS PC. The DIS PC will begin to run its power-up self-testing routine.
4. Once the system has completed the Auto Login sequence, the *Main Image* screen as shown below will display. (The start up will take approximately 120 seconds)



Main Image Screen with Standard Controls

While system is running the power-up self-testing routine a screen indicating that the system is initializing may appear. This screen will disappear once the Main Image screen displays.



NOTE: The exact buttons shown on the screen can vary for configurations.

NOTE: To ensure proper system operation, restarting the DIS every day is recommended.

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3.2 SWITCHING OFF THE SYSTEM

Precision MPi does not require daily power down. If it is necessary to shut down the system, make sure all sessions are closed and follow the recommended Power OFF sequence described here:

3.2.1 SWITCHING OFF THE GENERATOR

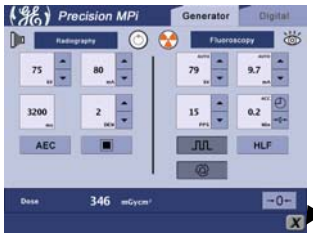
NOTE: Except for an emergency, the console should always be powered down by selecting SYSTEM SHUTDOWN, and then waiting for the touch screen console to switch off. If this sequence is not followed, there is a risk of data corruption in the console, requiring a reinstall of the touch screen software.

Exit the current screen(s) to return to the main console menu.

The generator will be powered off when the touch screen is switched off.

Press ⏻ to switch the generator off.

3.2.2 SWITCHING OFF THE REMOTE TOUCH PANEL



To switch off the RTP, press the Shut Down button and press Yes to Exit the application. The RTP will go through a Shut Down procdure (duration app. 20 secs.) and will power down automatically.

3.2.3 SWITCHING OFF THE POSITIONER

To switch off the positioner power, turn the on/off switch on the rear of the positioner against the clock until a click is heard and ‘off’ is shown in the window of the switch.

The power off procedure is complete when the positioner information monitor on the positioner is black.

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3.2.4 SWITCHING OFF THE DIS

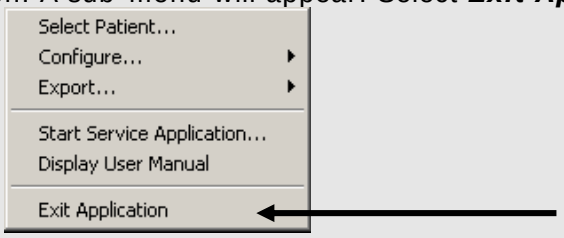
WARNING: Do not switch off the digital imaging system before all images have been copied or saved

As part of normal daily operation it is recommended to restart the Digital Imaging System computer every day.

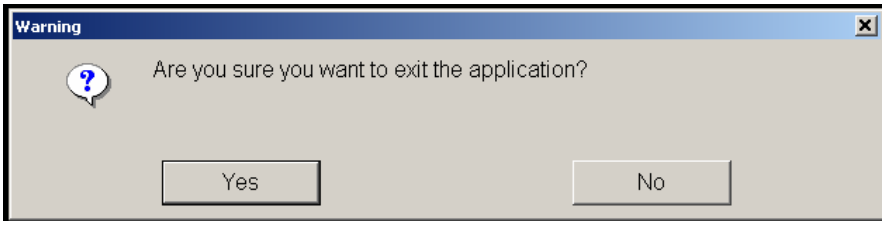
1. Close all patient files (instructions are given in Chapter 4.1.5 – Close a Patient File).

2. Select

NOTE: An alternate method is to position the cursor over the image portion of the screen, and right-click the mouse button. A sub-menu will appear. Select ***Exit Application***.

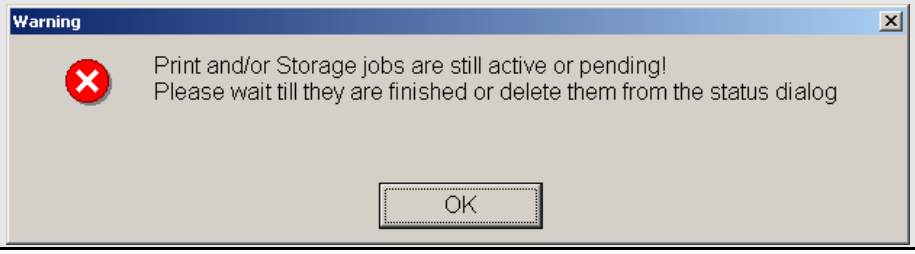


3. A confirmation request window will appear. Select **YES**.



NOTE: The *Clinical Application* cannot be closed if there are pending *DICOM* jobs.

If an attempt is made to *Exit* the program, a *Warning* will be displayed indicating that the program cannot be closed until the *DICOM* and/or *Print* jobs have processed through or are deleted.


Warning
Print and/or Storage jobs are still active or pending!
Please wait till they are finished or delete them from the status dialog
OK

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4. The Digital Imaging System will safely and automatically close the imaging software program. The computer is still considered ON.

NOTE: This process also logs off the current user. Anyone else wishing to use the system will need to log back on.

See instructions in Chapter 3.1.3 on Switching on the DIS.

Power Down

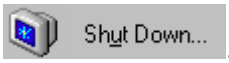
NOTE: To ensure proper system operation it is recommended that the Digital Imaging System computer be restarted every day.

CAUTION: DO NOT attempt to power down the DIS while images are being acquired.

CAUTION: DO NOT attempt to power down the system while images are being sent to a DICOM device or CD device.

CAUTION: DO NOT simply press the power button on the DIS PC. System errors may occur if the PC is simply turned off at the power button without following the proper shutdown procedures outlined below.

1. Close the DIS program. If necessary, follow the preceding instructions on closing the program, and then return to these instructions.
2. Select

(lower left corner of screen). A submenu opens.
3. Select 

. A new screen appears.

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4. Select "**Shut down**" from the pull-down list of options.

5. Select **OK**.

6. The PC will automatically power down.

CAUTION: If the Power Off function described above does not result in the PC being powered OFF, contact your site's Network Administrator or your service agency for assistance.

DO NOT simply press the Power button on the PC!

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3.3 GE PRECISION MPI MOVEMENTS

The various movements provided by the GE Precision MPi are illustrated in the figure below. The movement definition controls used for each movement and the sections describing the procedure to be followed are given in the table.

REF.	MOVEMENT	JOYSTICK	RANGE PA	SPEED	DESCRIBED IN CHAPTER
MAT	**Main Arm Tilt**		-90° to +90°	4° /sec	3.3.1.1
MCU	**Main Center Up/down**		810mm to 1390mm	21 mm/sec	3.3.1.2
MAC	**Main Arm Carriage (scan)**		-900mm to 600mm	20mm to 120mm /sec	3.3.1.3
CAT	**C-Arc Tilt**		-45° to +45°	8° /sec	3.3.1.4
CAR	**C-Arc Rotation**		-45° to 90°	8° /sec	3.3.1.5
TUD	**Patient table Up/down**		-300mm to 100mm	21mm /sec	3.3.1.6
TIO	**Patient table In/out**		-150mm to 260mm	28mm /sec	3.3.1.7
TTT	**Patient table Tilt**		-20° to +20°	4°/sec	3.3.1.8
IIE	**II Elevator**		90mm to 320mm	50 / 80mm /sec	3.3.1.9

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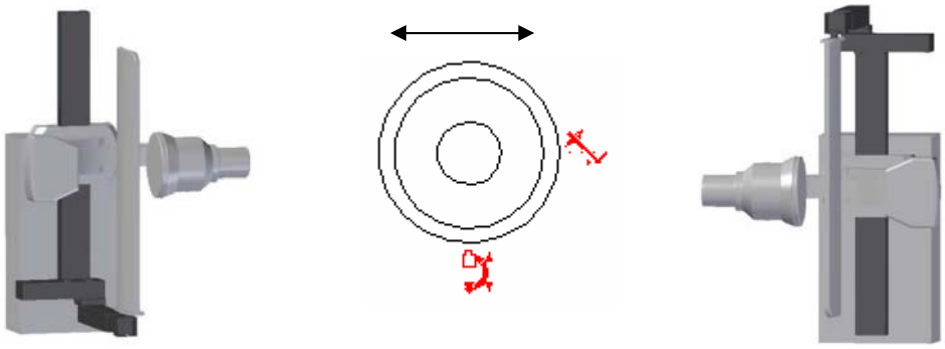
3.3.1 INDIVIDUAL MOVEMENTS

3.3.1.1 Main Arm Tilt



Main arm tilt +90° Main arm tilt -90°

The main arm is tiltable from 90 degrees head up to - 90 degrees head down (Trendelenburg) with a speed of 4 deg./sec.
The reset functions will bring the main arm tilt in 0° (horizontal). On the system user interface and the mobile control panel, the reset function is combined with reset function of the patient table lateral tilt.

WARNING: If the Trendelenburg position is to be used the patient must be securely fixed.

Automatic Movements

If the main arm tilt causes the collision safety system to activate, the main arm tilt movement will stop, but the main arm up/down movement will continue as long as the movement and the safety system is activated (See Chapter 3.3.2.5).

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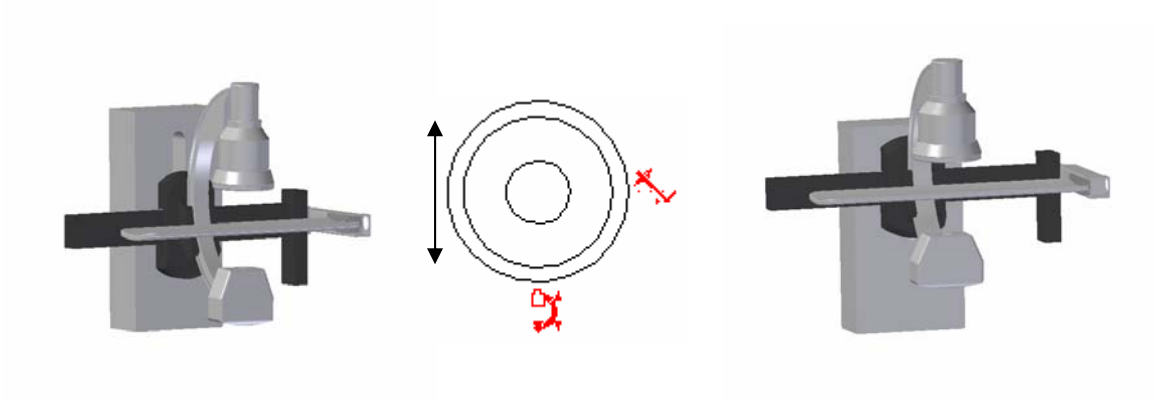
3.3.1.2 Main Center Up/Down



Main arm 81 cm (31.9 in) Main arm 139 cm (54.7 in)

The main arm rotation axis, the main centre, can be moved vertically from 810 mm to 1390 mm above the floor with a speed of 2.1 cm/sec (0.8 in/sec.).

The reset function will bring the patient table in lowest position.

Automatic Movements

By activating the main arm tilt movement, while the actual tilt position is between 0° and +90° and the tilt movement is in the direction of the 90° position, the main arm up movement is automatically activated until the tilt movement is stopped or the end of the main arm up trajectory is reached. Tilting from +90° to 0° position will automatically activate the main arm down movement.

By activating the main arm tilt movement, while the actual tilt position is between 0° and -90° and the tilt movement is in the direction of the -90° position, the main arm up movement is automatically activated until the tilt movement is stopped or the end of the main arm up trajectory is reached. Tilting from -90° to 0° position will automatically activate the main arm down movement.

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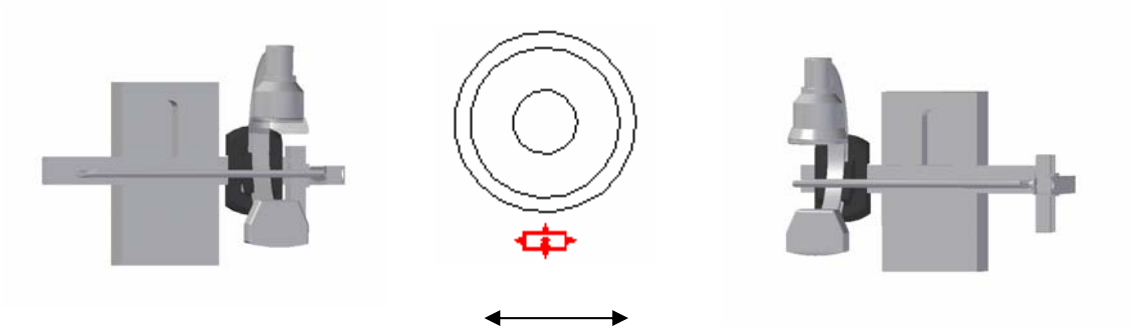
3.3.1.3 Main Arm Carriage (Scan)



C-arc scan 60 cm (23.6 in) C-arc scan - 90 cm (35.4 in)

The C-arc carriage can be moved from the center 90 cm (35.4 in) towards the head end and 60 cm (23.6 in) towards the foot end with a speed of max. 12 cm/sec (4.7 in/sec.). The speed is controlled by the joystick.

Automatic Movements

If a touchguard is activated during C-arc scan movement, the movement will stop and the safety movement of the patient table away from the touchguard has to be activated by activating the touchguard release button. The direction of the safety movement depends on the actual beam direction (See Chapter 3.3.2.5).

If the C-arc scanning causes the safety system to activate, the main arm will move upwards concurrently with continued C-arc scanning.

If necessary the C-arc scanning will stop, and the main arm will continue the upward movement as long as the movement and the safety system are activated.

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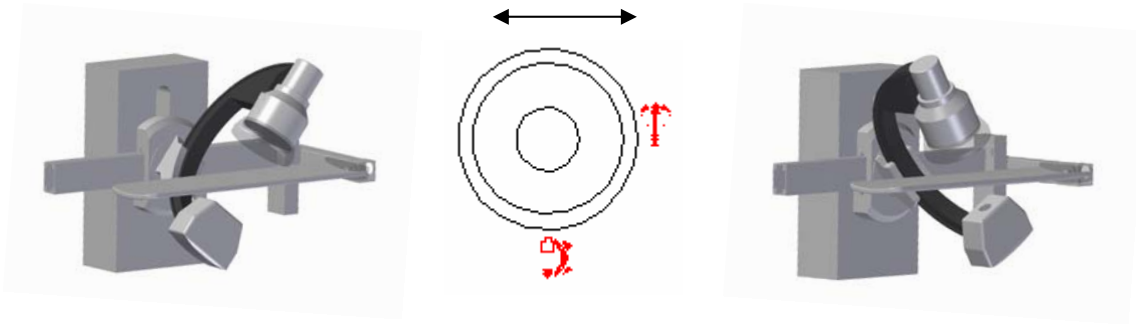
3.3.1.4 C-Arc Tilt



C-arc tilt 45° C-arc tilt -45°

The C-arc tilt is the second beam position movement, where the operator can make different projections through the patient.
The C-arc can be angulated +/- 45° with a speed of 8°/sec. The reset function will bring the C-arc tilt in 0°.

Automatic Movements

If a touchguard is activated during C-arc tilt movement, the movement will stop and the safety movement of the patient table away from the touchguard has to be activated by activating the touchguard release button. The direction of the safety movement depends on the actual beam direction (See Chapter 3.3.2.5)

If the C-arc tilt causes the safety system to activate, the main arm vertical movement will move upwards concurrently with continued C-arc tilting.

If necessary the C-arc tilting will stop, and the main arm will continue the upward movement as long as the movement and the safety system are activated.

Limitations

If the C-arc carriage is between + 45 cm (17.7 in) and + 60 cm (23.6 in) towards the foot end of the patient table, the C-arc tilt will be reduced depending on the position of the C-arc carriage.

The C-arc tilt movement is limited if the patient table is close to the C-arc, the Image Intensifier or the X-ray tube.

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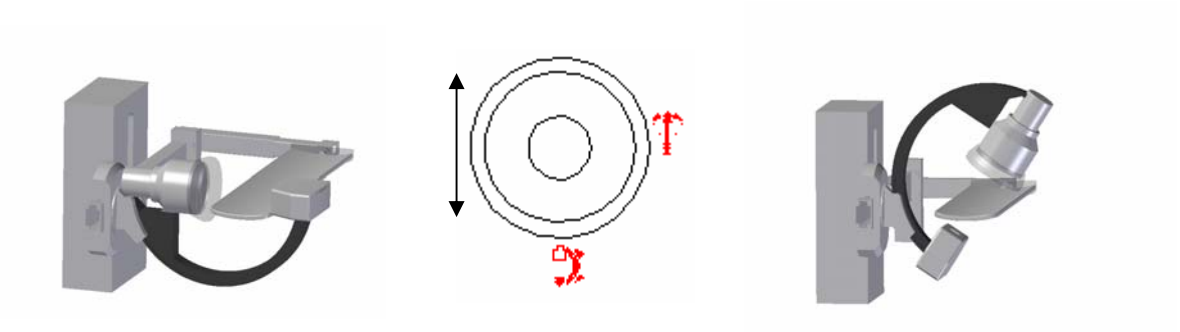
3.3.1.5 C-Arc Rotation



C-arc rotation -45° C-arc rotation 90°

With the C-arc rotation, the operator can make different beam projections through the patient. The C-arc can be moved from -45° to 90°.

The speed of the movement is 8 °/sec. The reset function will bring the C-arc rotation in 0°.

The illustrations above show the C-arc rotation in PA position. Please note that the C-arc is above the patient table in 90° rotation in AP position.

Limitations

The C-arc rotation movement is limited if the patient table is close to the C-arc, the Image Intensifier or the X-ray tube.

Automatic Movements

If a touchguard is activated during C-arc rotation movement, the movement will stop and the safety movement of the patient table away from the touchguard has to be activated by activating the touchguard release button. The direction of the safety movement depends on the actual beam direction (See Chapter 3.3.2.5)

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3.3.1.6 Patient table Up/Down

Patient table in +10 cm (3.9 in) position

Patient table in -30 cm (11.8 in) position

The patient table can be moved vertically from 10 cm (3.9 in) over the ISO-centre to 30 cm (11.8 in) under the ISO-centre with a speed of 2.1 mm/sec (0.8 in/sec)..

Limitations

The patient table up/down movement is limited if the patient table is close to the C-arc, the Image Intensifier or the X-ray tube.

Automatic Movements

If a touchguard is activated during patient table up/down movement, the movement will stop and the safety movement of the patient table away from the touchguard has to be activated by activating the anti-collision release button. The direction of the safety movement depends on the actual beam direction (See Chapter 3.3.2.5)

Battery Back-up

If the power supply should fail it could be difficult to remove the patient from the patient table. The patient table down movement is therefore equipped with a battery back up which moves the patient table downwards when the pushbutton placed on the left side of the base unit is pressed. This pushbutton is only active if the power supply fails.

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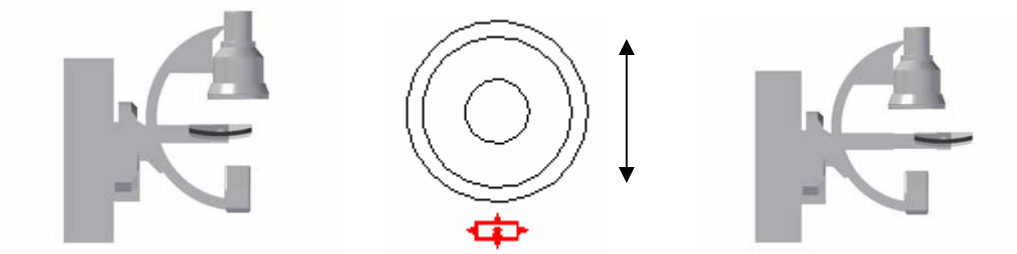
3.3.1.7 Patient table In/Out



Patient table in -150 cm (5.9 in) position

Patient table in +26 cm (10.2 in) position

The patient table can be moved laterally 15 cm (5.9 in) in the IN-direction and 26 cm (10.2 in) in the OUT-direction with a speed of 2.8 cm/sec (1.1 in/sec.).

Limitations

The patient table in/out movement is limited if the patient table is close to the C-arc, the Image Intensifier or the X-ray tube.

Automatic Movements

An automatic table in/out movement is performed in case of C-arc rotation and selection of PA/lateral or AP/lateral to enable the image intensifier and the X-ray tube to run free around the table.

If a touchguard is activated during patient table up/down movement, the movement will stop and the safety movement of the patient table away from the touchguard has to be activated by activating the anti-collision release button. The direction of the safety movement depends on the actual beam direction (See Chapter 3.3.2.5).

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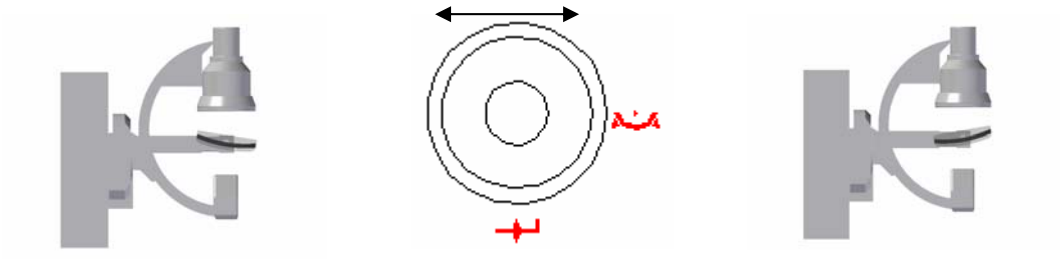
3.3.1.8 Patient table Tilt



Patient table in -20° position Patient table in 20° position

The patient table can be tilted laterally +/- 20° with a speed of 4°/sec. The reset function will bring the patient table on 0°.

WARNING: If the patient table tilt position is to be used the patient must be securely fixed.

Automatic Movements

If a touchguard is activated during patient table tilt movement, the movement will stop and the safety movement of the patient table away from the touchguard has to be activated by activating the anti-collision release button. The direction of the safety movement depends on the actual beam direction (See Chapter 3.3.2.5).

Limitations

The patient table tilt movement is limited if the patient table is close to the C-arc, the Image Intensifier or the X-ray tube.

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3.3.1.9 Image Intensifier Elevator

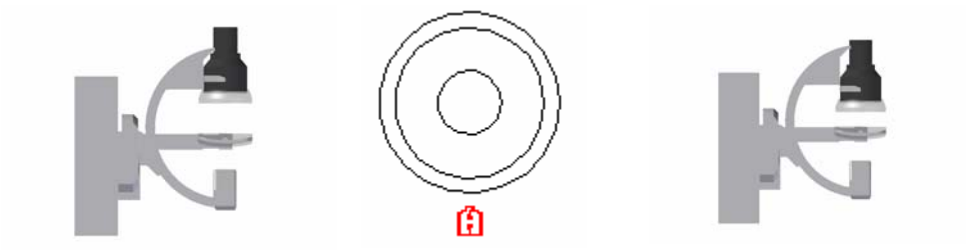

Image Intensifier in 32 cm (12.6 in) position Image Intensifier in 9 cm (3.5 in) position

The image intensifier movement is used for changing the distance between the image intensifier and the patient table. In the PA position, this function is very useful to create space between image intensifier and patient table for easy patient handling.
If a smaller distance between the image intensifier and the patient table is required the function Image Intensifier Elevator down is activated. The Image Intensifier can be positioned 9 cm (3.5 in) to 32 cm (12.6 in) above the ISO-centre with a speed of 8 cm/sec (3.5 in/sec) away from the patient and 5 cm/sec (2 in/sec) towards the patient. In the AP position the image intensifier elevator is automatically controlled to maintain a constant distance between the II surface and the patient table.

Limitations

The Image Intensifier Elevator movement is limited if the Image Intensifier is close to the patient table.

Automatic Movements

If the image intensifier touchguard is activated during Image Intensifier movement, the movement will stop and the safety movement of the patient table away from the touchguard will be activated as long as the anti-collision button activated. The direction of the safety movement depends on the actual beam direction as the patient table will always move away from the activated touchguard (See Chapter 3.3.2.5).

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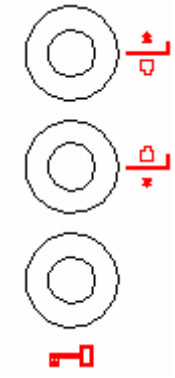
3.3.2 COMBINED MOVEMENTS

3.3.2.1 Selection of PA / AP

The purpose of this function is to use the GE Precision MPi whether in PA mode or AP mode depending on the type of examination to be performed.



To change the mode, activate the button for the wanted mode and at the same time activate the key-button. The two-button activation is introduced in order to avoid unintentional PA/AP change.

When changing PA/AP mode the below points shall be observed:

1. During change of AP/PA mode no patient must be on the table.
2. When the AP/PA mode change procedure has been initiated, the procedure shall be continued until it is finished and a beep signal is heard. This means, it is recommended to keep pushing the two buttons until the procedure is finished. If the change procedure is not completed, the procedure can be continued by pressing both key-button and mode button again for min. 20 secs whereafter the mode change continues.
3. If the AP/PA mode change procedure is stopped before it is finished, the same mode button as was activated should be re-activated together with the key-button in order to finish the procedure that was initiated. Please notice that the key button in this case may have to be activated a few seconds before it is possible to finish the procedure by pressing the two buttons.

WARNING: None of the accessories that can be used on the positioner contain any anti collision features. Therefore, the operator must be very attentive to avoid collision during AP/PA mode change when any accessory is used on the GE Precision MPi.

3.3.2.2 Selection of Lateral Beam Axis

The purpose of this function is to allow a fast rotation of the C-arc from either PA or AP to lateral beam axis. This also requires lateral movement of the patient table in order to achieve sufficient space for the image intensifier between the main arm and the patient table. The patient table up/down together with the main arm up/down might also be activated to allow the C-arc to run freely around the patient table.

To rotate the C-arc from PA position to lateral beam axis (90 degrees), activate the button for lateral beam axis. The patient table will now move outwards and the C-arm will rotate to 90 degrees. The patient table has to move in vertical direction in order to obtain the horizontal beam axis (the isocentre) and is placed appr. 14 cm (5.5 in) under the top level.

To rotate the C-arc back to PA position with vertical beam axis (0 degrees) activate the button for vertical beam axis. The patient table will move laterally to the centre position when the C-arc has passed 55° and the C-arc will rotate to 0 degrees. The patient table will move in vertical direction and is placed appr. 26 cm (10.2 in) under the top level, and centered in relation to the beam.

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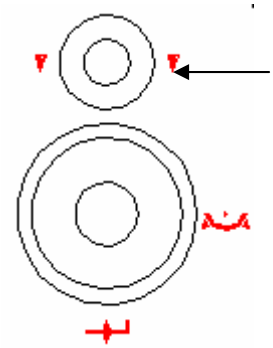
To rotate the C-arc from AP position to lateral beam axis activate the button for lateral beam axis. The patient table will now move outwards and the C-arm will rotate to a horizontal position with the C-arc over the patient table and the X-ray tube in the front.

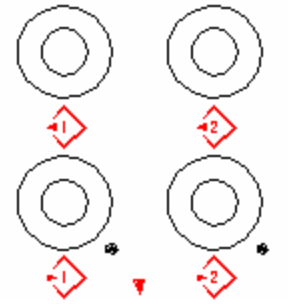
To rotate the C-arc back to AP position with vertical beam axis (0 degrees) activate the button for vertical beam axis. The patient table will move laterally to allow the C-arc to run freely around the patient table, and will at the end of the movement be centered in relation to the beam. The distance between the image intensifier and the patient table will be as small as possible.

3.3.2.3 Patient Access function



With the patient Access function it is possible to bring the patient table to the lowest possible height and provide the patient with a very low step up.
Pushing down the button for patient access activates this function. The function will also bring the main arm to the lowest possible position and position the other movements in a convenient position.

3.3.2.4 Memory positioning



After having positioned all movements to a proper position, the operator can store the actual positions in memory by pressing the store function on the control panel. Hereafter the operator can re-position any required movement of interest. Pressing the recall 1 button on the control panel will reposition the movements of the positioner to the stored values. When the position is reached a beep is heard. 2 different memory stores are offered. LEDs indicate use of the memory positions 1 and 2.

3.3.2.5 Collision Prevention and Safety Movements

Collision against the Image Intensifier and/or collimator

In order to avoid collision between the image intensifier or the collimator and the patient or the patient table, the image intensifier and the collimator are equipped with touchguards. If a touchguard is activated all movements except the movements for main arm up/down and main arm tilt will stop, an audible signal will sound and a collision message appears on the generator touchscreen and positioner monitor. In order to release the touchguard from such a locked position a safety movement of the patient table in direction away from the touchguard can be initiated by pressing the anti-collision button on the control panel.

The direction of the safety movement depends on the actual beam direction and the patient table will always move away from the II-touchguard towards the x-ray tube or vice versa. The safety movement will continue as long as the anti-collision button is activated and the touchguard is activated.

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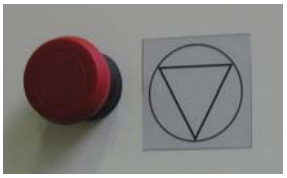
In case of a simultaneous activation of II and collimator touchguards no movement will be activated when the anti-collision button is pressed down.
To recover from the collisions, one of the two collision causes must be solved or the override button can be used. The override button is placed on the left side of the positioner next to the emergency stop. It is the same button as used for moving the patient table downwards in case of power failure.



WARNING: When the **Security Override** button is activated, any movement is possible and all automatic anti-collision features are disengaged. Be careful not to cause collision with the patient and/or floor and ceiling as this may cause serious injury to the patient or damage to the system. The function is active only when the power to the system is switched on.

Collision against the Ceiling or the Floor of the examination room

The system is protected against ceiling/floor collision by a safety system, which calculates the distance between the mechanical parts of the GE Precision MPi and the ceiling/floor.
If the safety system is activated, the critical movement(s) is (are) stopped. Escape from this situation is possible with all movements that affect the collision situation.

Collision against the Floor

The system is protected against floor collision by a safety system, which calculates the distance between the mechanical parts of the GE Precision MPi and the floor.

If the safety system is activated, the critical movement(s) is stopped. Escape from this situation is possible with all movements that affect the collision situation.

WARNING: None of the accessories that can be used on the positioner contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when any accessory is used on the GE Precision MPi.

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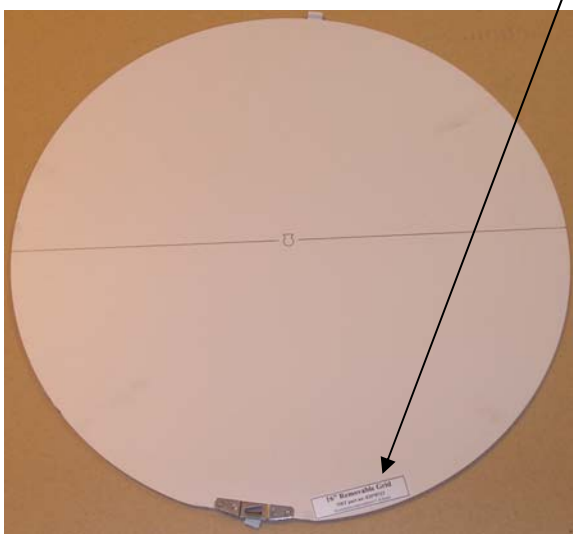
3.4 REMOVABLE GRID

16” Removable Grid	12” Removable Grid
NRT part no: 02978723	**NRT part no: 02978623**
Aluminum equivalence < 4.0mm	Aluminum equivalence < 4.0mm

Label for Removable Grid (Label is positioned as indicated)

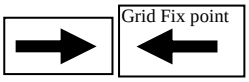


The grid is located between the Image Intensifier and the Image Intensifier Touchguard. Remove the grid by removing the grey cover plate, pressing the center of the cover plate while rotating counter clock wise. Thereafter, remove the grid by removing the 4 red cap screws.

Aluminum equivalence for standard grids is 0.016 inches (4.0 mm).

NOTE: Remove the grid prior to performing pediatric procedures.

The Grid is correctly mounted when indicators on the Grid and II Touchguard point towards each other as shown below:



WARNING: Do not operate the equipment until the II cover plate has been attached again. Operating the system without the cover could cause serious or fatal personal injury.

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4.1 WORKING WITH PATIENT FILES

Prior to acquiring images, a patient file must be established. This may be done either by entering the patient data manually or importing the patient data automatically using the **DICOM Work List** feature.

This section will explain the various ways to access and change the patient data.

4.1.1 New Patient File – Entering Patient Data Manually

1. From the ***Main Image*** screen, click on the **Patient List** button.

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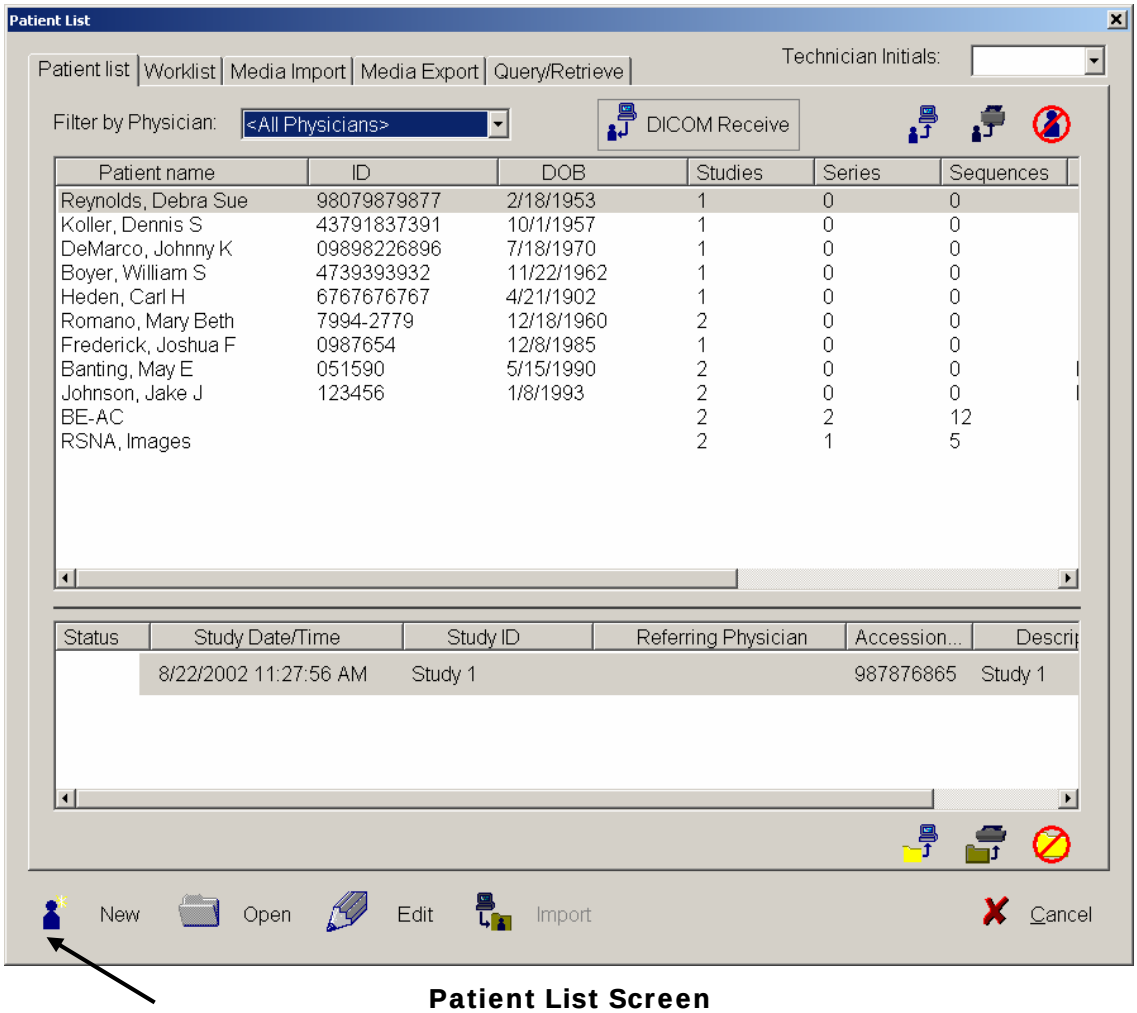
2. Enter tech initials. This can be done manually or by using the arrow to display drop-down menu of predefined initials. Technician Initials:



Patient List Screen

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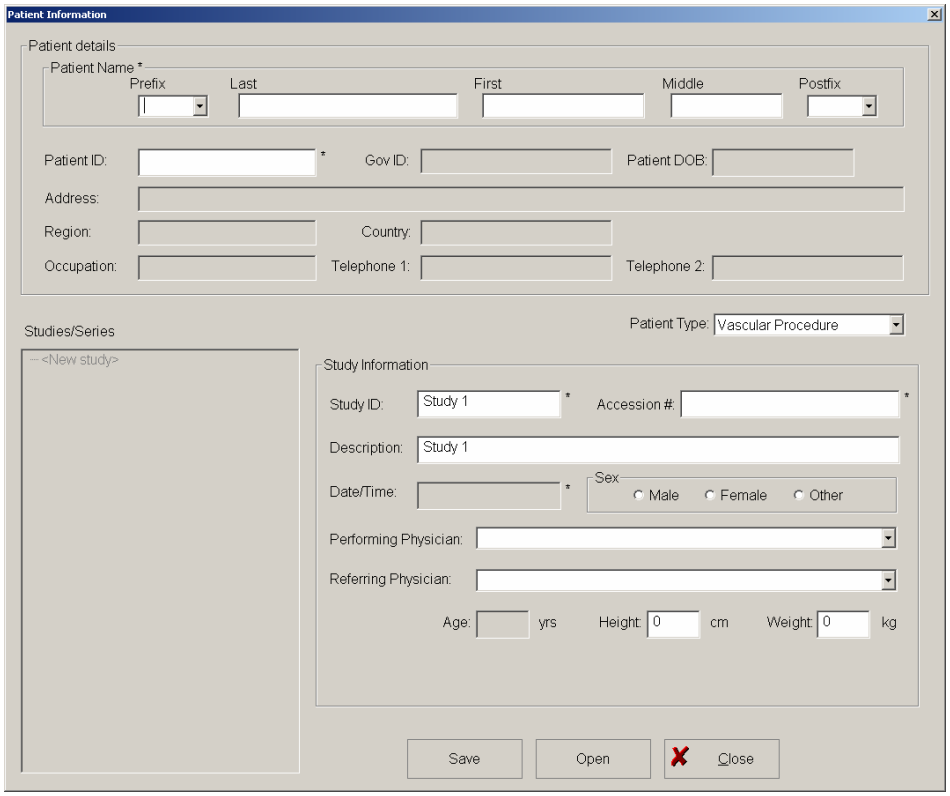
3. From the ***Patient List*** screen click on the

button to open the ***Patient Information*** screen.



New Patient Entry Screen

4. Click the left mouse button to position the cursor over each field where data is to be entered. Use the mouse, the tab key or enter key on the keyboard to move between entries.

- Some fields may be unavailable – indicated by *grayed-out* field box. These fields were deactivated for your system. Contact your service engineer to have them activated.

- Specific settings for General Acquisition, Review, Reference Display, Printing and Archive Transfer as well as Fluoro, Spot and Sub-Fluoro can be made from the Performing or Referring Physician fields. See chapter 4.3 for details on establishing these Physician features.

- Fill in the fields with as much patient information as is available. Some fields are required and are indicated by an asterisk (*).

- Several of the selections have drop-down menus for quickly selecting data and are indicated by a small downward arrow next to the field.

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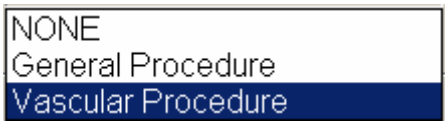
Prefix	Type in Prefix to be used or use down arrow to select from a list of those previously entered. Highlight selection to be reflected in Patient file:
Postfix	Type in Postfix to be used or use down arrow to select from a list of those previously entered. Highlight selection to be reflected in Patient file.
Patient Type:	Use down arrow to select from available options:  Highlight procedure type to be reflected in Patient file.

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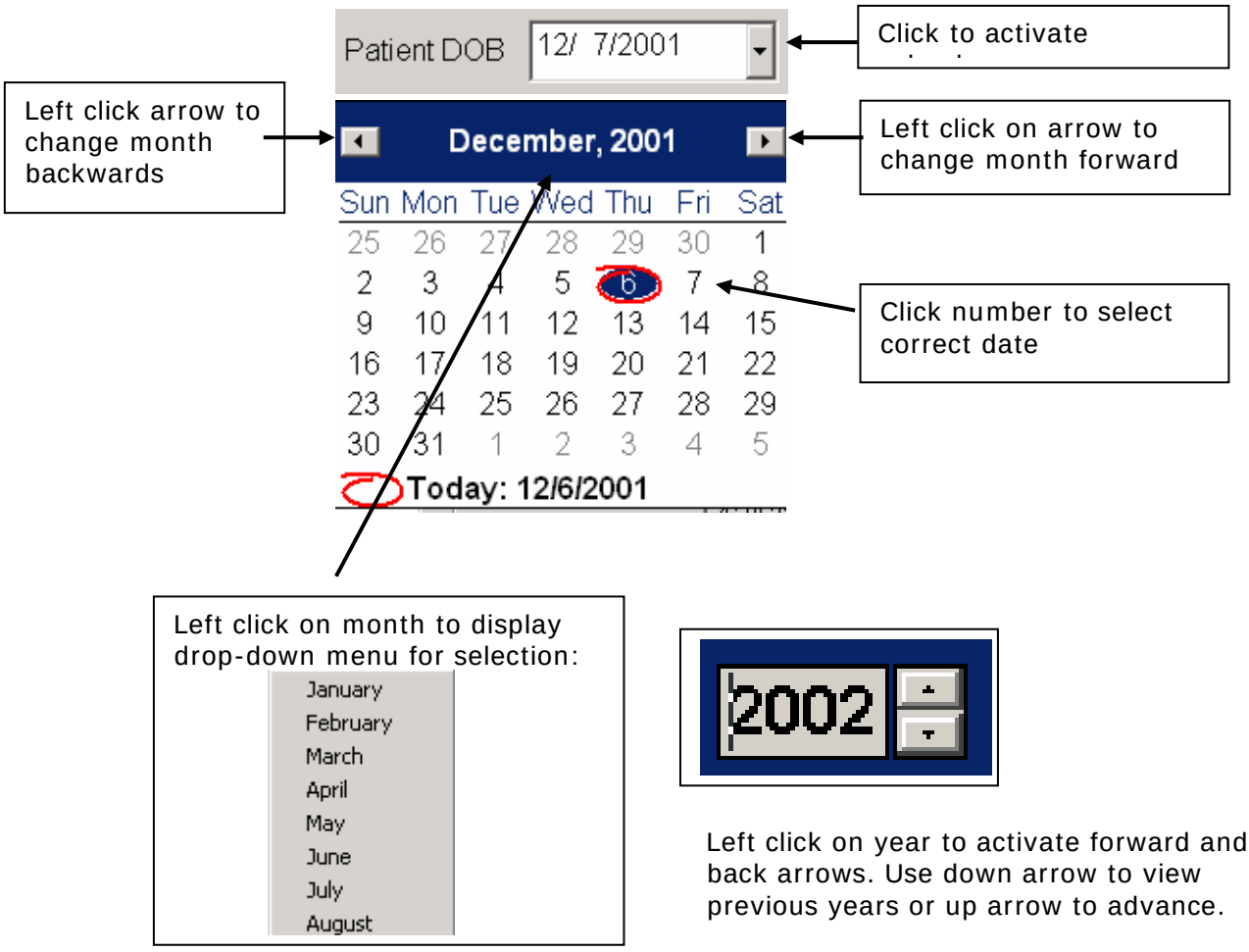
4.1.1.1 Date of Birth Calendar

The Patient DOB (Date Of Birth) text box includes a calendar function to use when selecting the month, date and year. The DOB field and calendar default to current date.

NOTE: This function must be enabled within the Service Application.


Patient DOB
12/ 7/2001
Click to activate
Left click arrow to change month backwards
December, 2001
Left click on arrow to change month forward
Sun Mon Tue Wed Thu Fri Sat
25 26 27 28 29 30 1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31 1 2 3 4 5
Today: 12/6/2001
Click number to select correct date
Left click on month to display drop-down menu for selection:
January
February
March
April
May
June
July
August
2002
Left click on year to activate forward and back arrows. Use down arrow to view previous years or up arrow to advance.

4.1.1.2 Complete Data Entry

When patient data entry is complete, select one of the following options:

Save	The SAVE button saves the patient data to the database. The ***Patient List*** screen reappears so that additional patient files can be added.
Open	The OPEN button saves the patient data and opens the patient file for acquisition. Patient information will display on-screen.
Close	The CLOSE button cancels this patient data. The patient data recently entered will not be saved. The ***Patient List*** screen will reappear.

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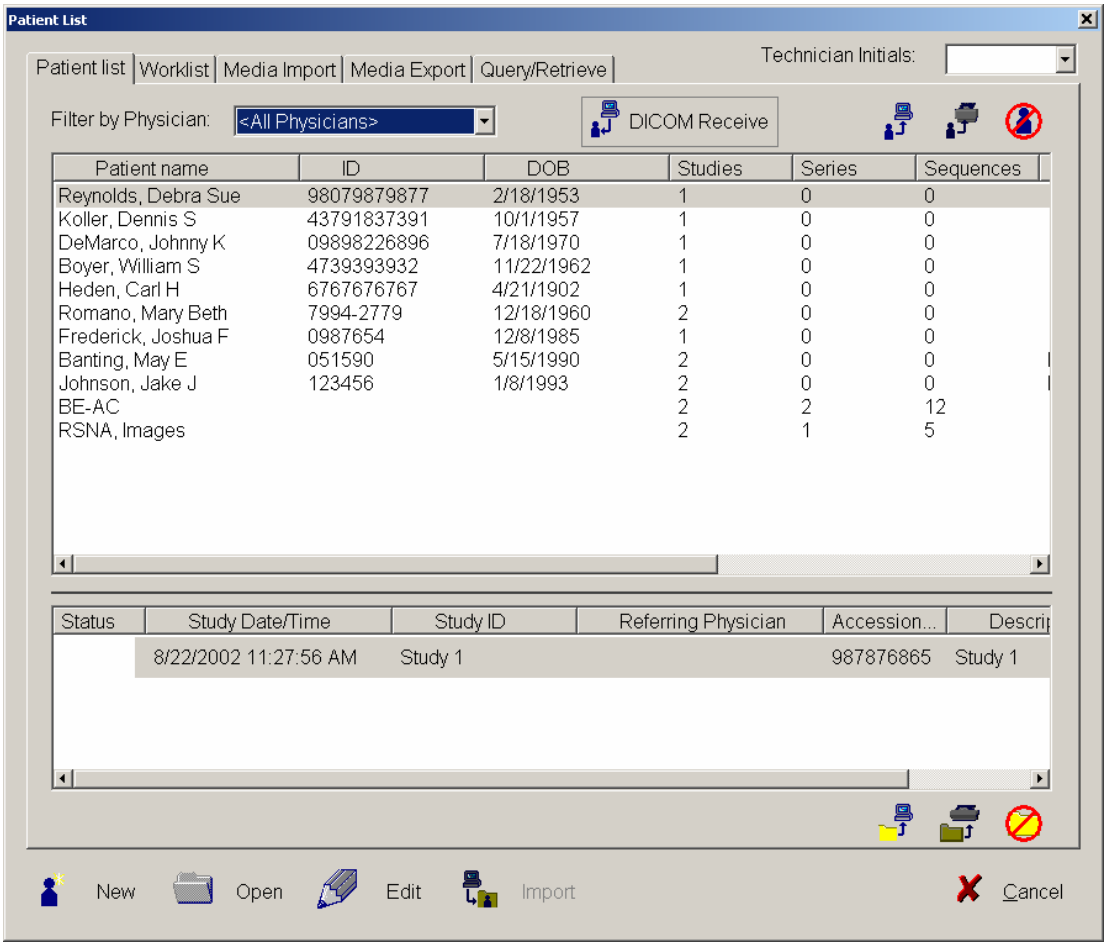
4.1.2 Edit Patient Data

1. From the ***Main Image*** screen, click on **Patient List** button.
2. The ***Patient List*** screen will appear.



Patient List Screen

3. Position cursor over any part of the preferred patient file and click the left mouse button.

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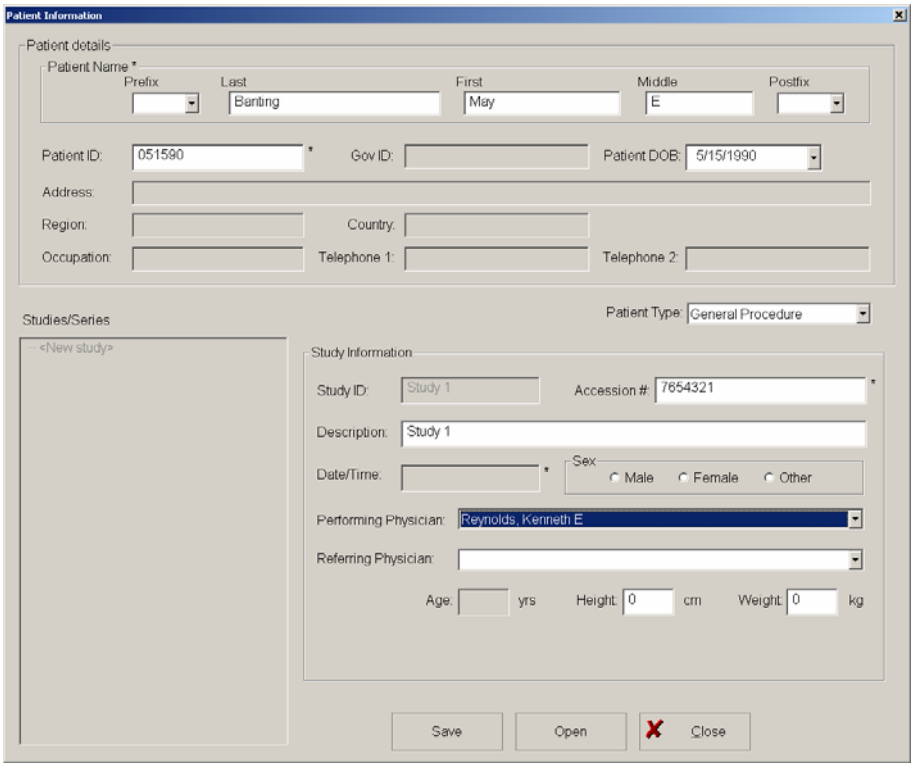
4. Click

. The ***Patient Information*** screen will appear.



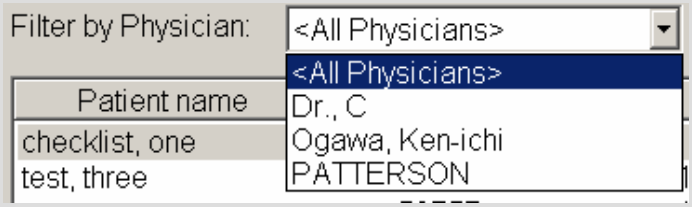
Patient Information Screen

5. Make required changes or additions to patient file.
   - To enter a new study, select <new study>, enter Study Description (enter manually or use predefined study description – see chapter 4.1.2.1), Physician Information, and other pertinent data.
   - Position the cursor over each space where data is to be entered using the mouse, or use the tab key or Enter key to move between entries and complete all necessary fields.

6. When data entry is complete, click on one of the following buttons at the bottom of the screen:

Save	The Save button saves the patient data to the database. The ***Patient List*** screen reappears so additional patient files can be added.
Open	The Open button saves the patient data and opens the patient file for acquisition. Patient information will display on-screen.
✘ Close	The Close button cancels this patient data. The patient data recently entered will not be saved. The ***Patient List*** screen will reappear.

NOTE: Use Filter by Physician option to select patient for a specific doctor.



Click on down arrow to display list of physicians, highlight physician. The physician list is displayed alphabetically.

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4.1.2.1 Patient Hierarchy

Patient images are organized by *studies.* A study might also be referred to as a folder and is further subdivided representing all of the images taken on one specific day or subsequent days. The DIS offers the flexibility to set up studies to meet the physicians' specific requirements. Images can be added to an existing study or a new study can be created.

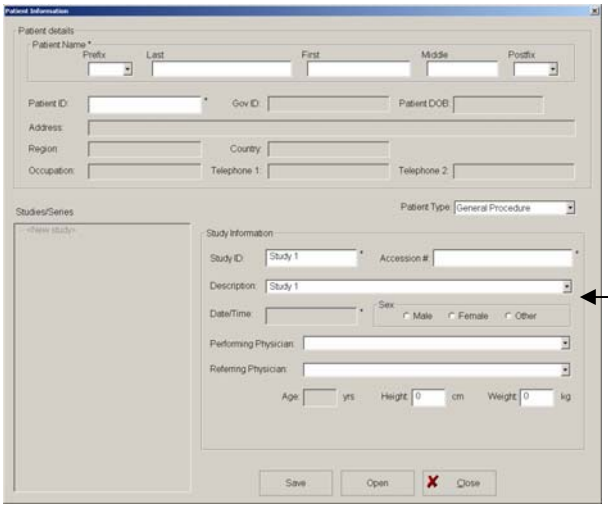
Each study contains another subdivision referred to as a *series.* Images within a series are taken in one imaging session. Once a patient session is closed, the series closes. When a new session begins, a new series is added. Within each series are *sequences* of images. Whether it has single or multiple images, each image loop is considered a sequence.

When a new patient file is set up, "Study 1" is automatically established and images acquired are assigned to "Series 1" and then Sequences 1,2,3 etc. You can also select a study description from a list of predefined study descriptions when setting up a new patient or editing existing patient data. A dialog box is available to use to describe images within the series. This information can either be added prior to image acquisition or during image review and processing.

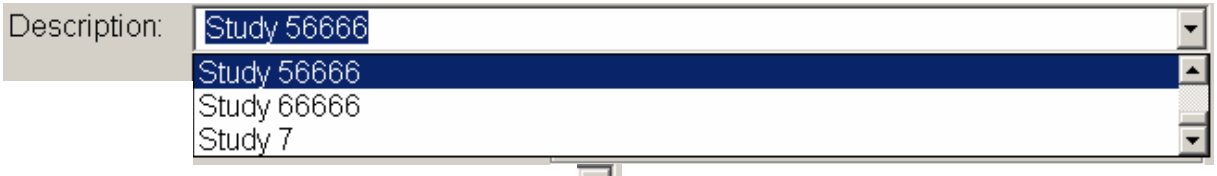
Studies

Predefined Study List: Quickly select from a list of predefined study descriptions. From the Patient Information screen:

1. Click on the down arrow in the Description field under Study Information.



2. Use Description field in the Study Information box to name the first study.



3. Enter a title manually or click to view list of predefined study titles. If no description is selected, the default description is "Study 1" (or Study 2, 3 or 4…).

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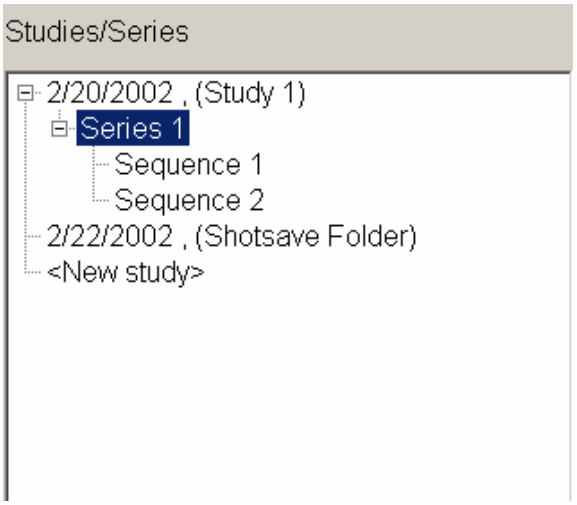
Up to ten custom descriptions can be added. Once the maximum is reached, the system will replace the oldest entry with the new one.

NOTE: Once a description is entered manually, it is added to the predefined list and can be used in the future for similar types of studies.

Series

Series – When editing a patient study, each new session adds a new series.



The computer automatically assigns the Series number but changes can be made to Series Information by using the ***Series Information*** screen.

To access ***Series Information*** screen:

1. Select Patient name from Patient List screen and click the **Edit** button. The patient information screen will display.

2. Position the cursor over the series to be edited and left click once to highlight. The Series Information screen will replace the Study Information screen.

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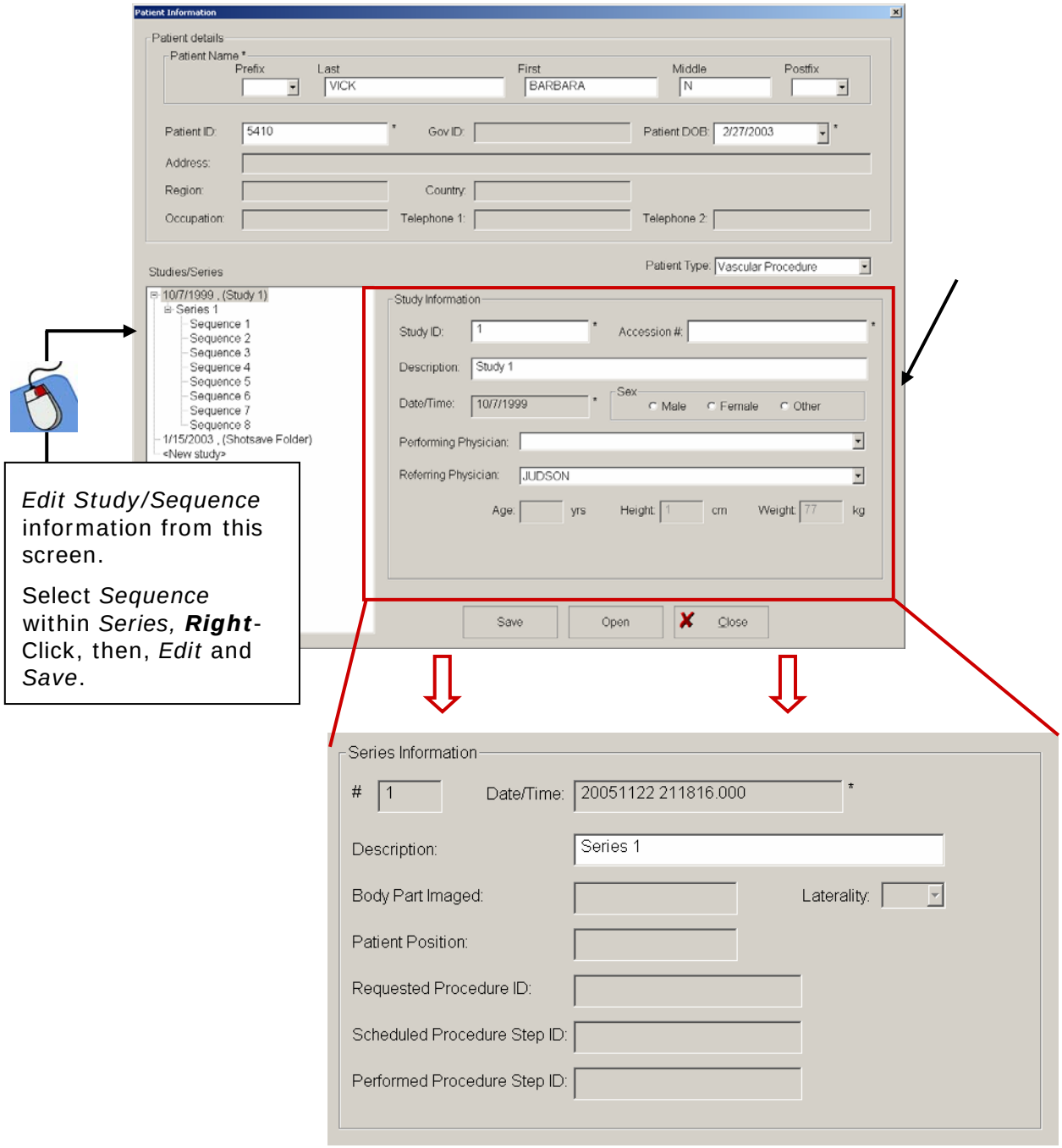

Series Information Screen

3. Enter information and then click Save at the bottom of the Patient Information screen.

This screen can also be used to edit or append series data.

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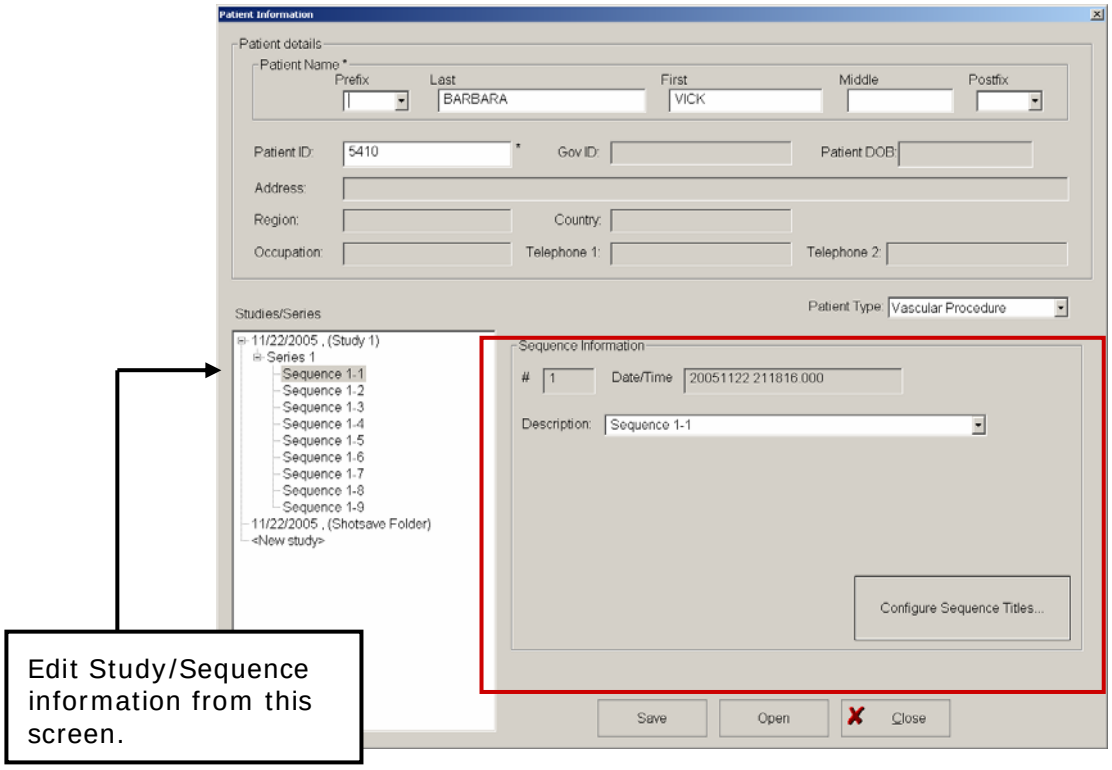
Sequence Information

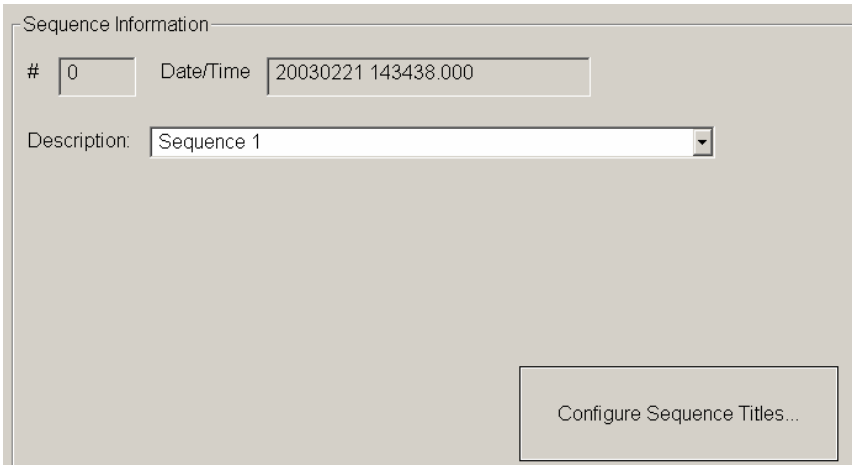
The Sequence Information screen will display the date and time the sequence was created. It can also be used to add sequence titles to a list of those predefined for future use.

To access the ***Sequence Information*** screen:

1. Select Patient name from Patient List screen and click the Edit button. The patient information screen will display.



2. Position cursor over the Sequence to be edited and left click once to highlight. The Sequence Information screen will replace the Study Information screen.



Use to review date and time.

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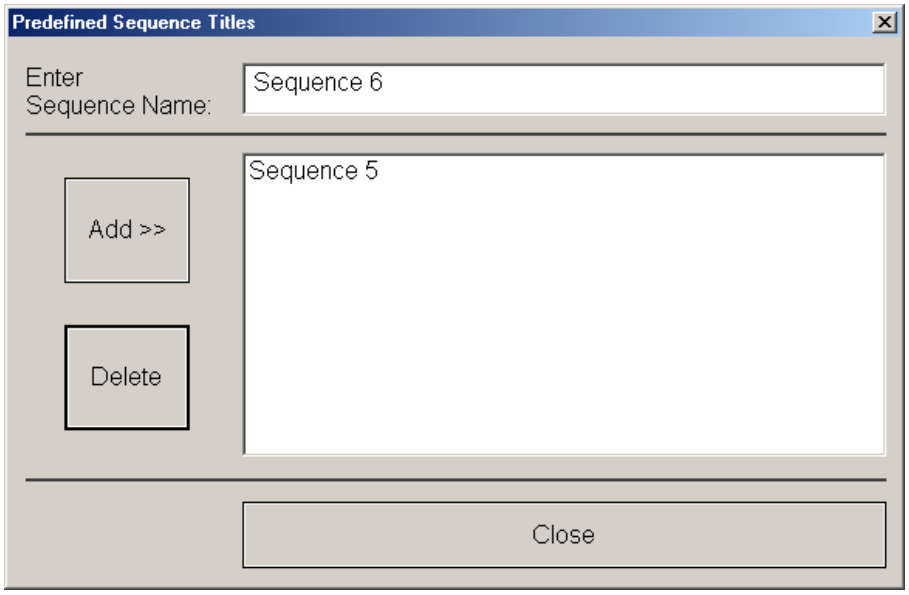
To Configure sequence Titles:

1. Click Configure Sequence Titles... . The Predefined Sequence Titles screen will display.
2. Add or delete sequence title using the predefined list as needed and then click Close .



Refer to chapter 4.4 for instructions on Programmable Sequences.
Additional information on working with sequences - Sequence Title Edit, Sequence Selection, Sequence Replay, etc.- is provided in chapter 7 (Reviewing Images).

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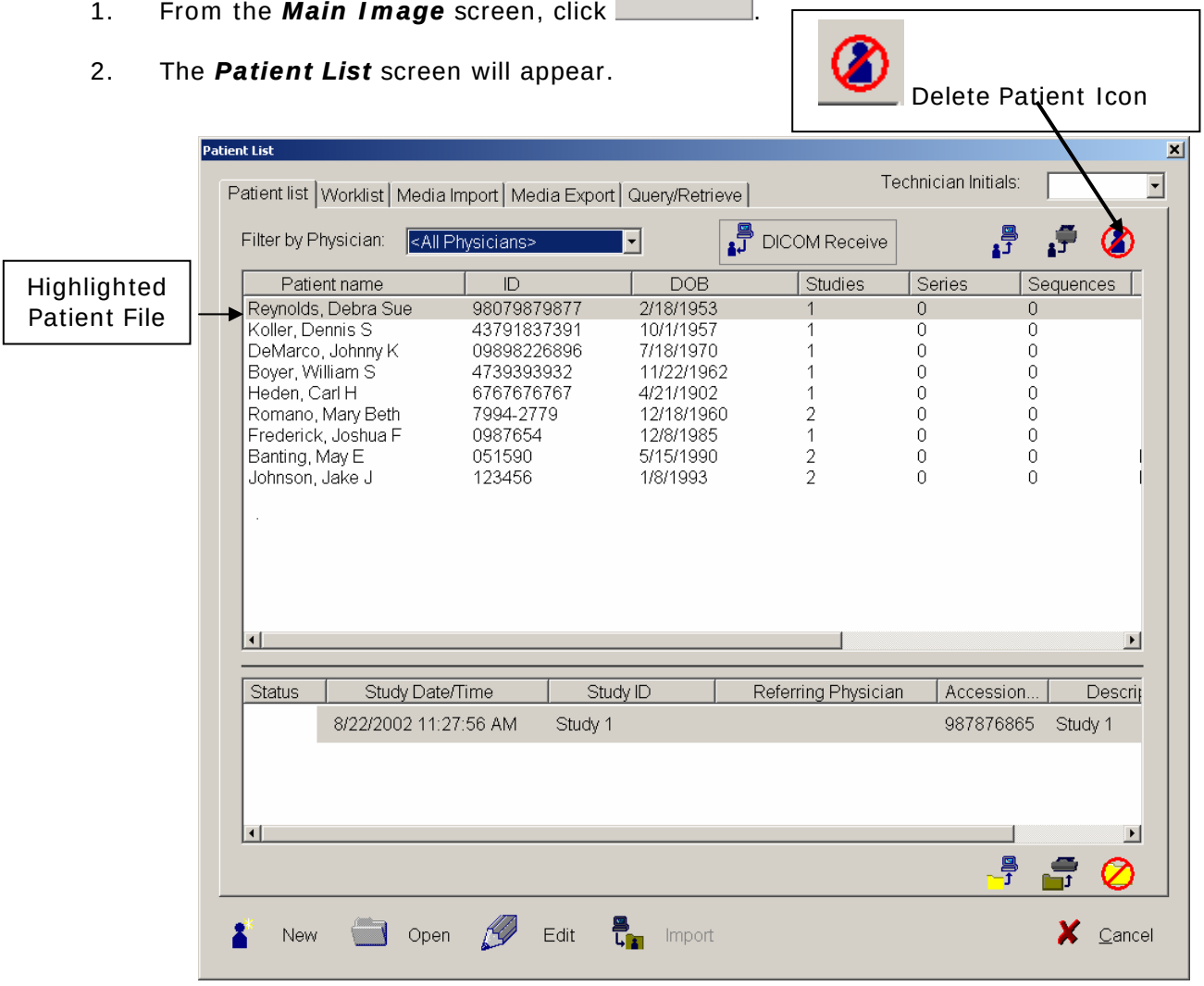
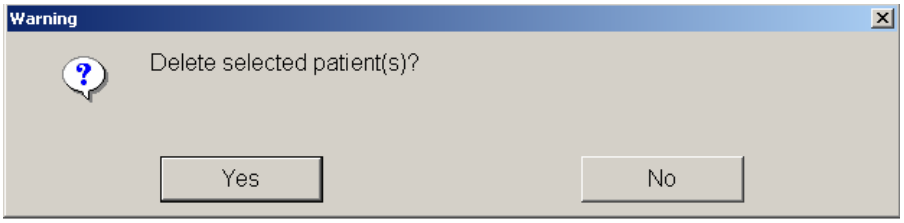
4.1.2.2 Delete Patient File

1. From the ***Main Image*** screen, click .
2. The ***Patient List*** screen will appear.



Patient List Screen

3. Highlight patient file to be deleted. To delete more than one patient, hold down the "Ctrl" key on the lower left of the keyboard and single left click on each patient file to be deleted.
4. When selection(s) are made, click the delete button in the top right portion of the ***Patient List*** screen.
5. If the Warning option is configured in the Service Application, a warning will display asking for confirmation of this action.



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6. Select <Yes> and the patient file(s) will be deleted – Select <No> and the selected ***Patient List*** will display again.

7. If attempting to delete an open patient, a warning will appear indicating the patient is locked and cannot be deleted.

4.1.2.3 Delete Images

An image can be deleted when a patient file is open and the image to be deleted is visible on the screen.

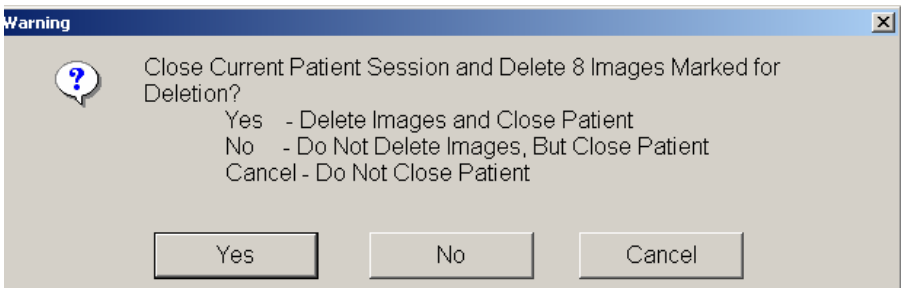
NOTE:	For Multiple Image Display, the preferred image must be highlighted with a square box.

1. Select the **Delete Frame** button. The text notation, "**D**" will appear in the bottom right portion of the screen, above the Window & Level settings in the Main image display area. For multiple image display, a "**D**" will appear in the bottom left portion of the screen.

2. Repeat step 1 to mark additional images for deletion.

3. When the patient file is closed, a warning will appear detailing the number of images marked for deletion.

   - Select **Yes** to delete the marked sequences and close the patient file.
   - Select **No** to close the patient file without deleting any images.
   - Select **CANCEL** to cancel request to close the patient file (no images will be deleted).


Warning
Close Current Patient Session and Delete 8 Images Marked for Deletion?
Yes - Delete Images and Close Patient
No - Do Not Delete Images, But Close Patient
Cancel - Do Not Close Patient
Yes
No
Cancel

CAUTION: Once the patient file is closed and the images deleted, there is no way to restore the images (unless the images were stored elsewhere).

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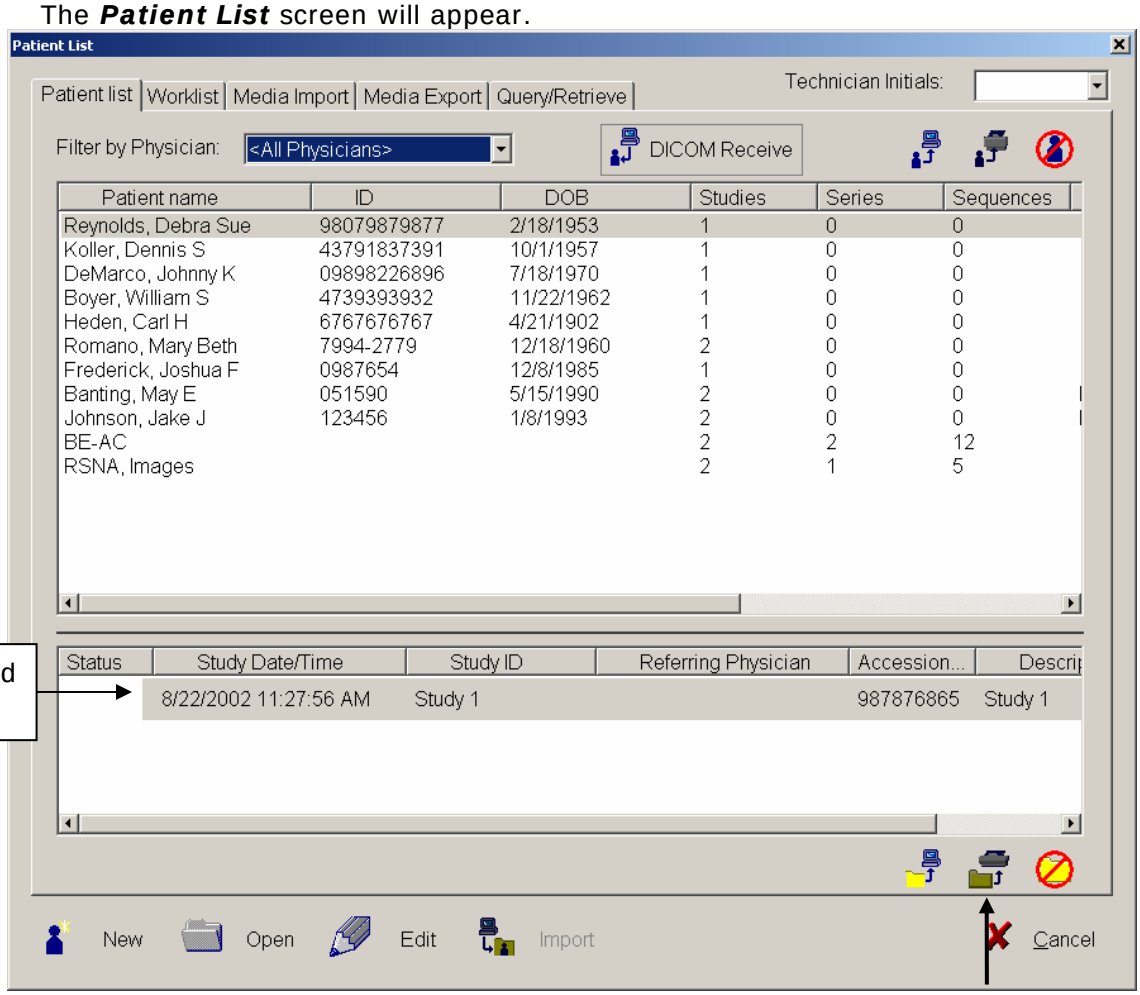
4.1.2.4 Delete Patient Studies

A patient study can be deleted while leaving the patient data and remaining studies intact.

1. From the ***Main Image*** screen, click on **Patient List** button.

2. The ***Patient List*** screen will appear.



Highlighted study

Patient List Screen

Delete Study Icon

3. Highlight patient ***study*** to be deleted. To delete more than one study, hold down the "Ctrl" key on the lower left of the keyboard and single left click on each study to be deleted.

4. Click the ***delete study*** button in the lower right portion of the Patient List screen.

5. If this option is configured in the Service Application, a warning will display asking for confirmation of this action.

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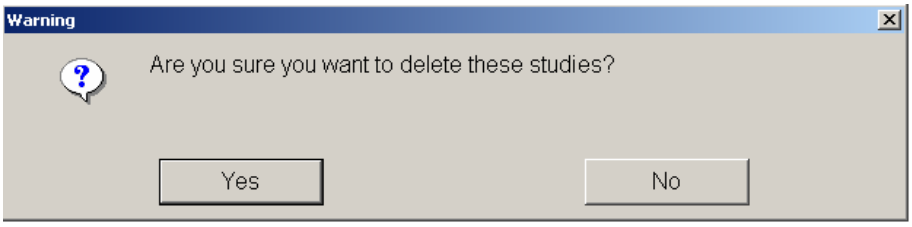


6. Select <Yes> and the studies(s) will be deleted – Select <No> and the Study will display again.

4.1.2.5 Delete a Sequence of Images

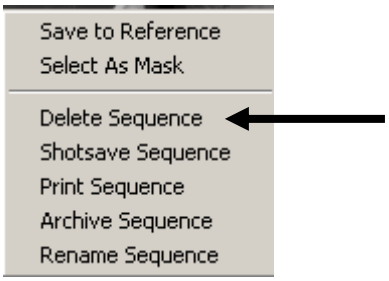
- A Sequence is a sequence of images within a study.
- Each sequence of images is shown as a Thumbnail on the Display Area.
- Each sequence of images is numbered automatically as it is acquired.
- When a sequence is deleted from a study, the original numbers for the remaining sequences will be retained.

Example of Sequence Numbering:

If a study originally included sequences 1:1, 1:2, 1:3, 1:4, 1:5, 1:6 and sequence 1:3 is deleted; the remaining sequences will retain their original numbers and sequence 1:3 will no longer appear in list.

Original Sequence Numbering	***Deleted Sequence Number***	***New Sequence Numbering***
1:1, 1:2, 1:3, 1:4, 1:5, 1:6	Delete Sequence 1:3	1:1, 1:2, 1:4, 1:5, 1:6

1. Open the preferred patient file and select the **Thumbnail** button if not already active to display the thumbnails.
2. Position cursor over the thumbnail representing the sequence to be deleted, and right click.
3. From the ***Right-click menu***, select the **Delete Sequence** option.



4. A "D" will mark the sequence for deletion in the upper right corner of the Thumbnail image and in the lower right corner of the ***Main Image*** screen if the image is currently displayed.
5. Repeat these steps to mark other sequences for deletion.
6. When the patient file is closed, a warning will appear detailing the number of images marked for deletion.

   a. Select **Yes** to delete the marked sequences and close the patient file.
   b. Select **No** to close the patient file without deleting any images.

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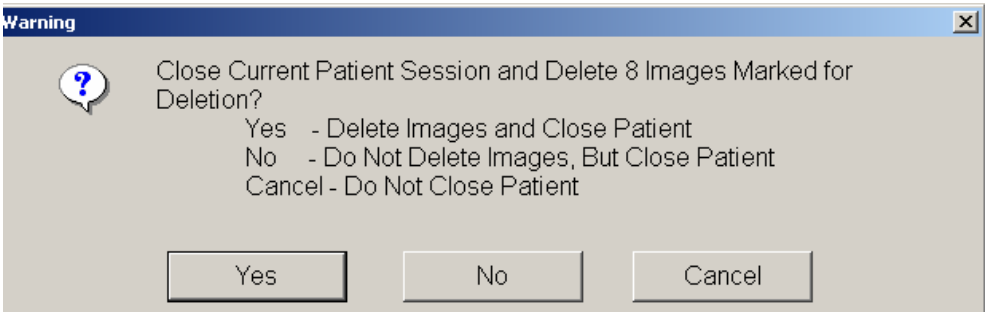
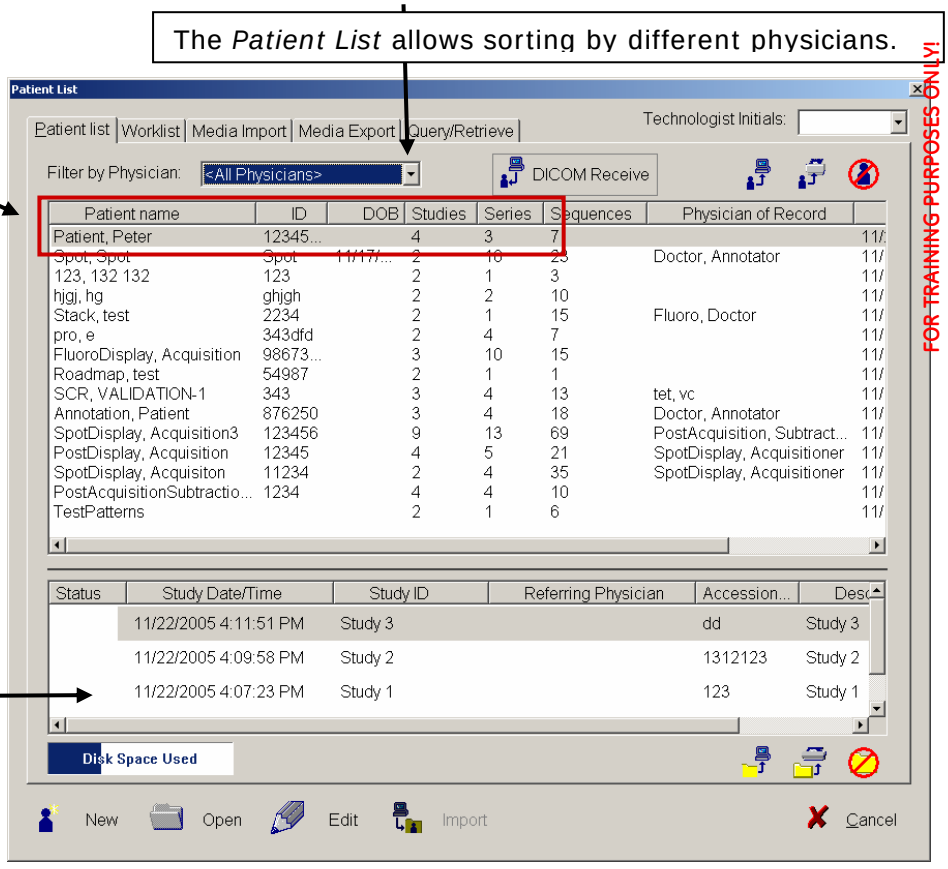
c. Select **CANCEL** to cancel the patient closing request (no images will be deleted).


Warning
Close Current Patient Session and Delete 8 Images Marked for Deletion?
Yes - Delete Images and Close Patient
No - Do Not Delete Images, But Close Patient
Cancel - Do Not Close Patient
Yes
No
Cancel

Close Patient File Confirmation Request

4.1.2.6 Sorting the Patient List

The ***Patient List*** can be sorted by Patient Name, ID, DOB, Physician of Record or Study Date. To sort the patients by a specific field, click on the column's title.



1. In the Patient Information Area, the *Patient List* allows sorting by Patient Name, ID, DOB, Physician of Record or Study Date. To sort the database by a specific field, click on the Column's Title.

2. In the Study Information Area, the Patient List allows sorting by Study ID, Study Date/Time, Referring Physician and Description. To sort the database by specific field, click on the Column's Title.

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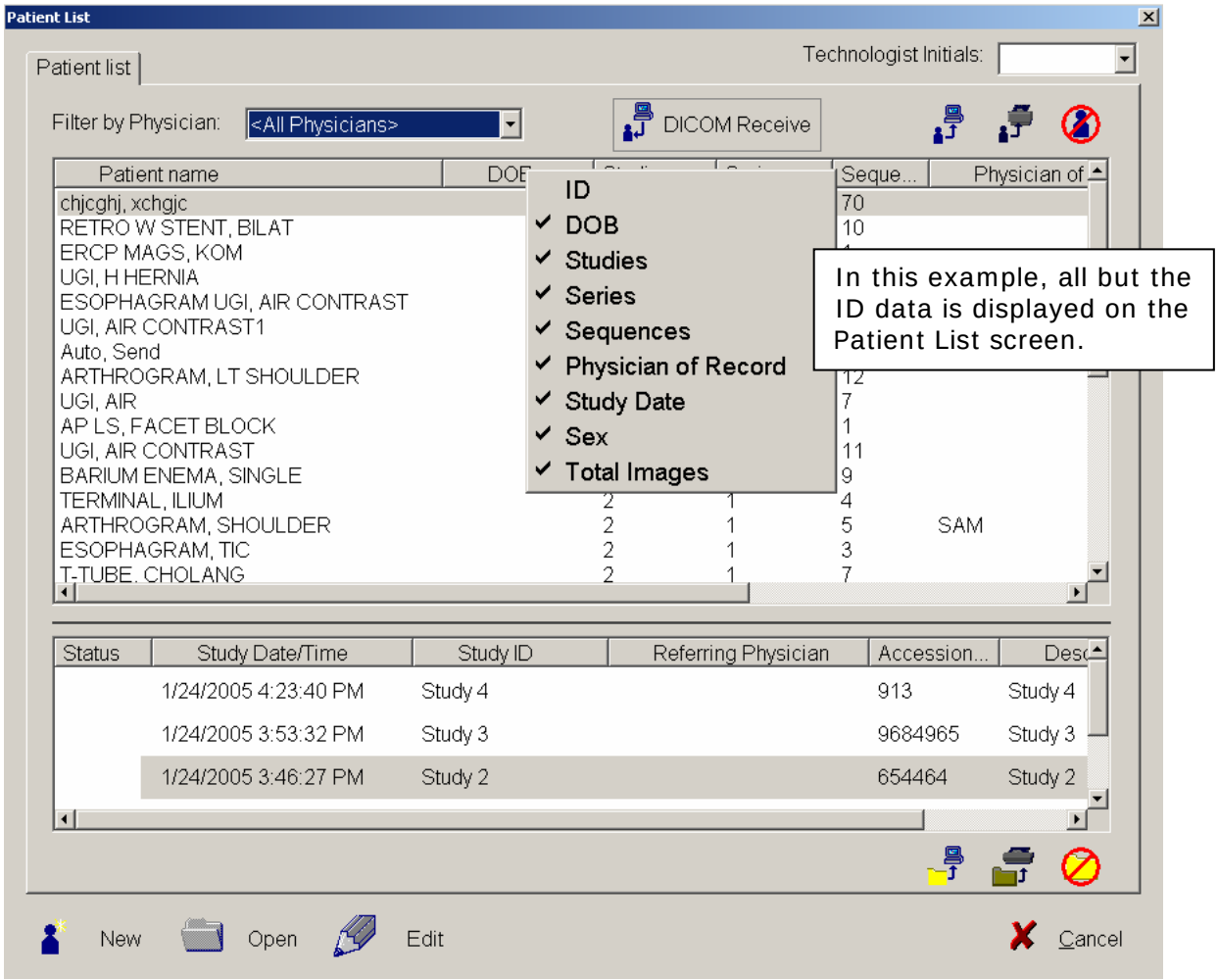
4.1.2.7 Customizing the Patient List Screen

The Patient List screen is configured so that nine different columns of pertinent information can be displayed – ID, DOB, Studies, Series, Sequences, Physician of Record, Study Date, Sex, and Total Images. However, columns can be easily removed from the display if they are not needed.

Position the Cursor over the Header Bar and **right** click. A Sub-menu will display, and a Check mark will appear next to the Title of each Header currently displayed on the screen. To eliminate that Column from the screen, left click on the Check mark, the Column will be eliminated from the display. The Column can be added back by reversing this procedure and putting a Check mark next to its Title.



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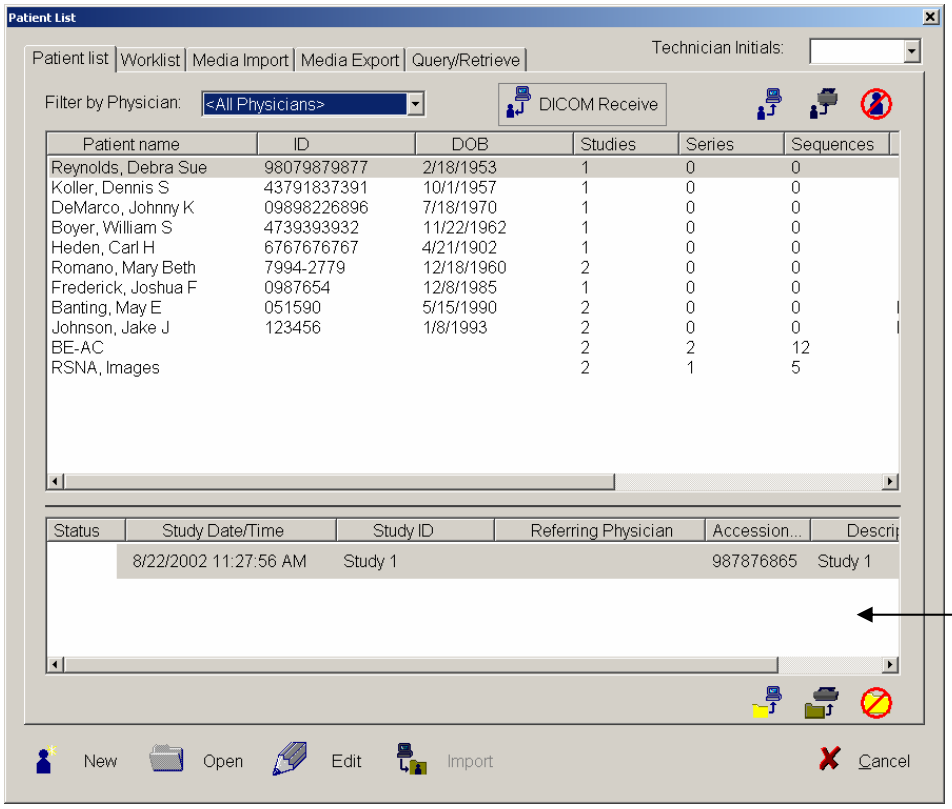
4.1.3 Open Existing Patient File

1. From the ***Main Image*** screen, click .

2. The ***Patient List*** screen will appear (see below). Position cursor over any part of the preferred patient file and click the left mouse button.

3. Highlight the study you desire to open.

4. Click **OPEN**. The system will open the patient file and selected study.



Shortcuts:
Double-clicking the desired patient file will open whatever *Study* was already highlighted.

Double-clicking on a specific study for a patient will open that study.

Study Information

Patient List Screen

5. To Review images refer to Chapter 7 of this manual for more information on the *Review* Functions.
6. To acquire images for this patient file click

from the ***Main Image*** screen.

CAUTION: When adding images to a patient file, verify that the correct patient has been selected by comparing all of the patient information. Patient data can be verified on the ***Patient List*** and in the upper portion on the ***Main Image*** screen.

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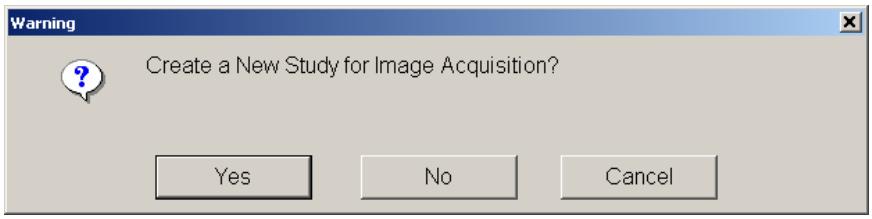
7. A prompt will appear - use the instructions that follow to acquire new images to the current study or start a new study.

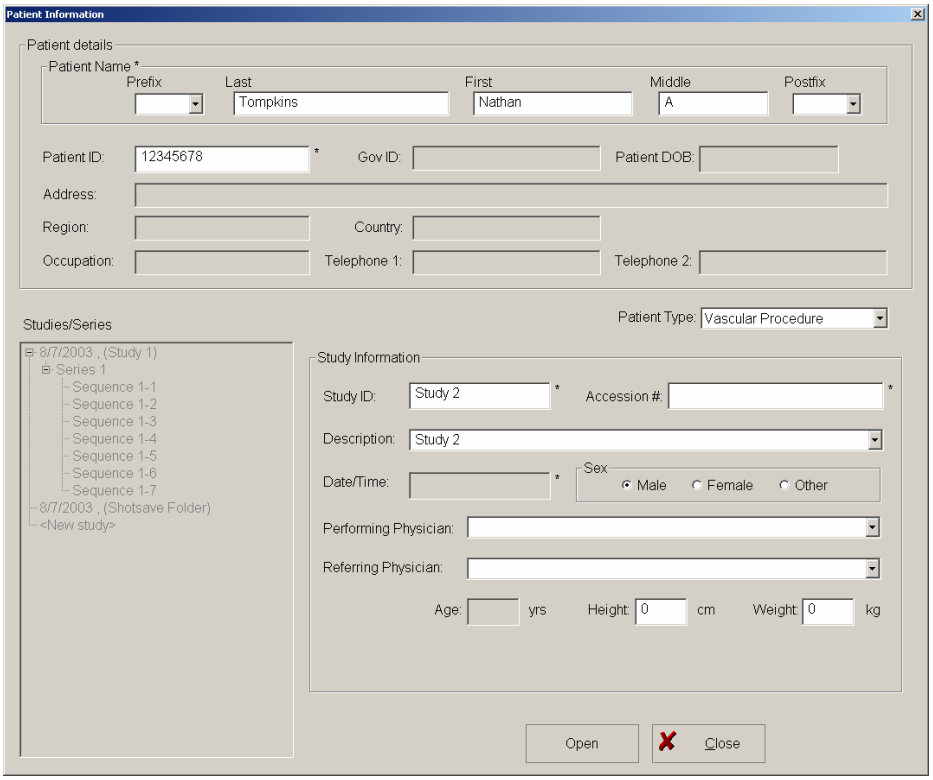


4.1.3.1 Acquire / Add new Images to current Study

1. Select **NO** at the prompt. The screen will return to ***Main Image*** screen.
2. See Chapter 6 of this manual for more information on the *Acquire* functions and features.

4.1.3.2 Acquire / Add new Images - Create New Study

1. Select **YES** at the prompt.
2. The ***Patient Information*** screen will open.



Patient Information Screen

3. Fill in the information for the study (right side of the screen). Note the required fields are identified with an asterisk (*). These fields must be filled in.
4. Click Open.
5. See Chapter 6 of this manual for more information on the *Acquire* functions and features.

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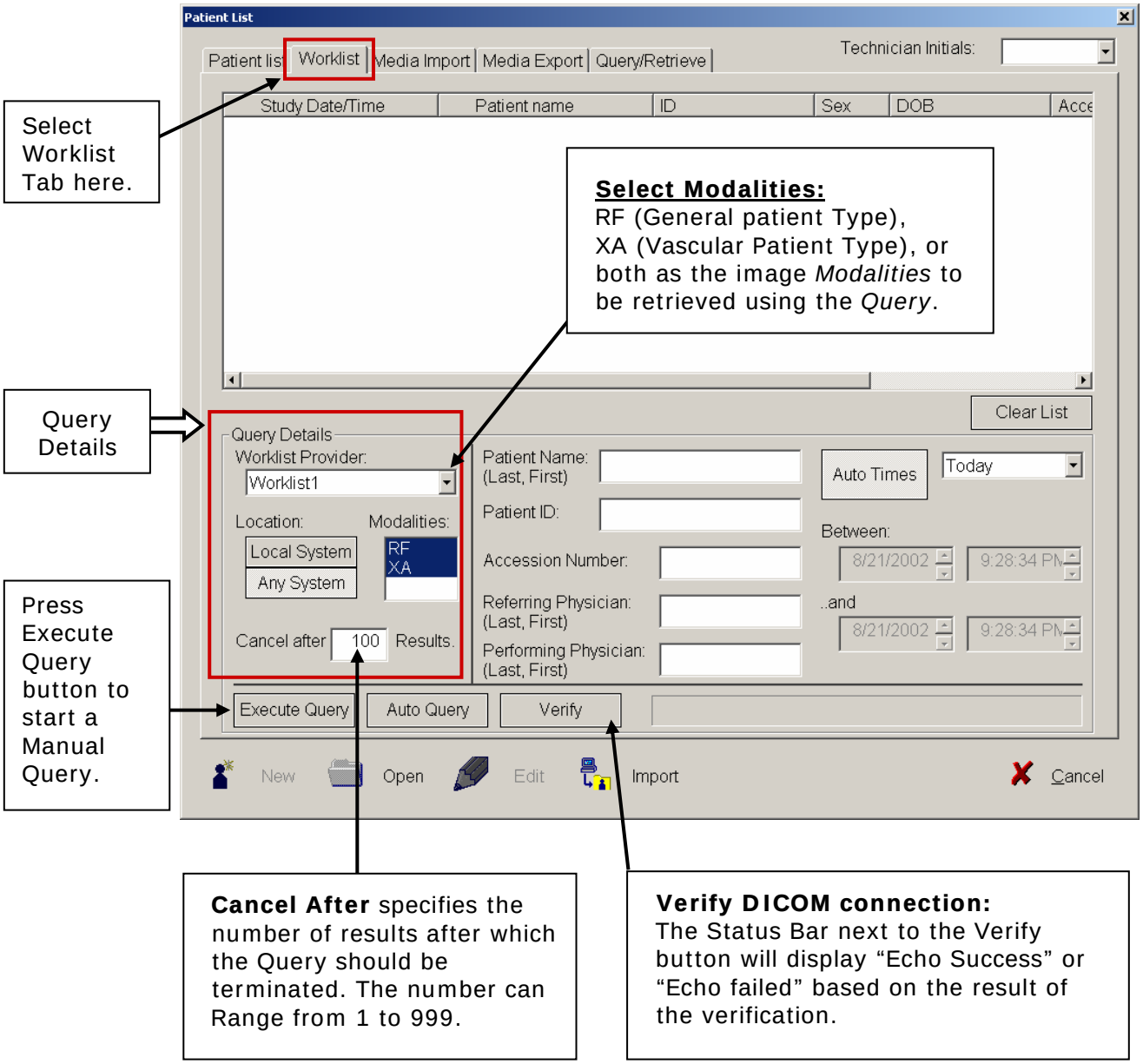
4.1.4 Import Patient Data Using DICOM Worklist Feature

Use the Worklist feature to search a database (usually a centralized database connected via a DICOM network) for patients based on specific criteria. Look for groups of patients, or a specific *Patient File*. This feature is used to search by patient data only - not images.

1. To access Worklist tab from Main Image screen, click on *Patient List*
2. Select the Worklist *t*ab. The Worklist *s*creen will display.

4.1.4.1 Manual Query – Manual Searching of Patient Files

The user will select Query Details to *Set-up* the ability for Manually Querying the DICOM Worklist server (from a Local System or Any System). The Worklist Providers are configured from the Service Application.



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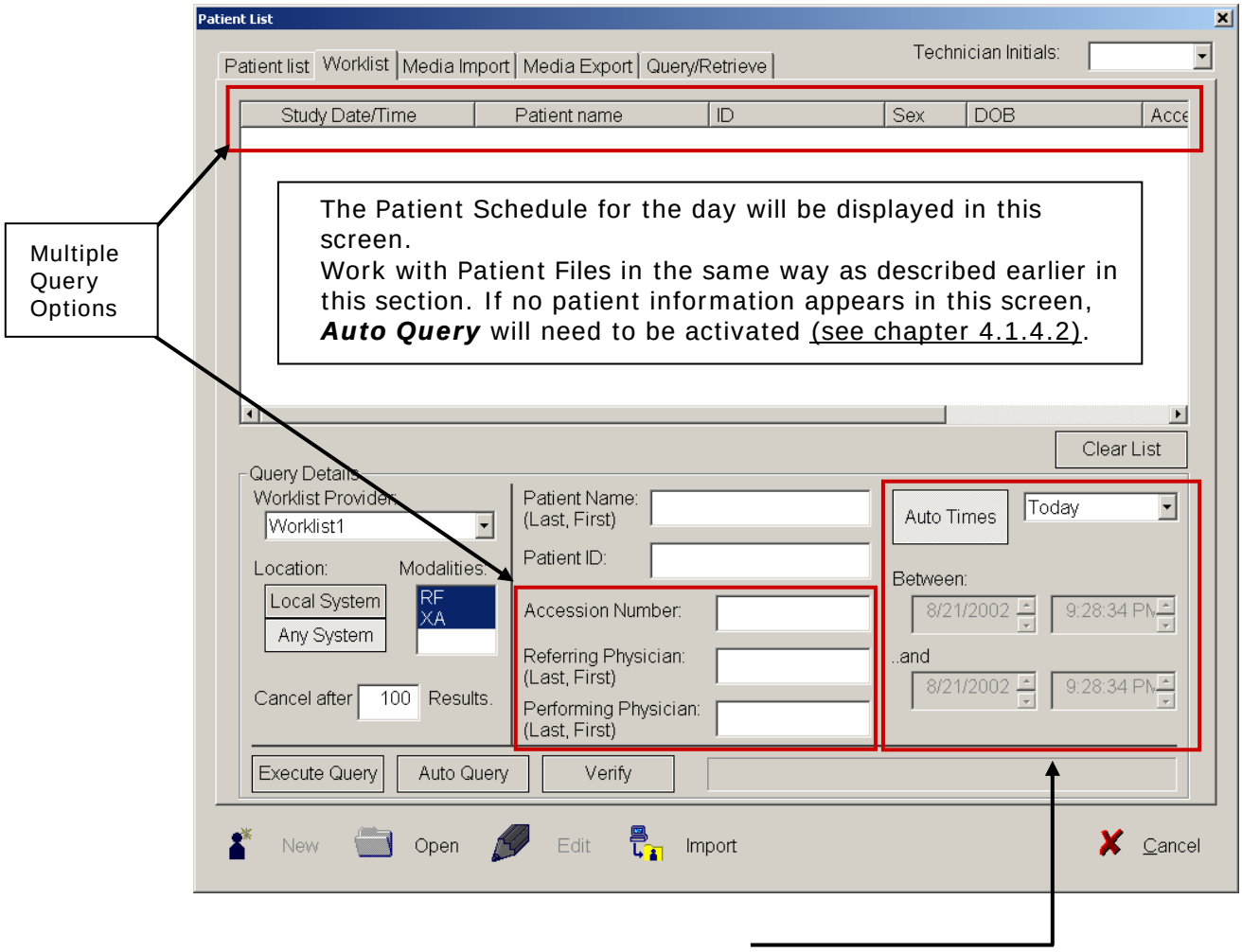
Manual Query Execution

A *Query* can be constructed using any combination of the following fields*:* Patient Name, Patient ID, Accession Number, Referring Physician and Performing Physician. Only DICOM compatible characters can be used in *Query* strings and the strings are not case sensitive. Wildcard Characters are allowed*.*



The Auto Times Button and Combo Box:

The Auto Times and Combo Box Enables the user to select from four options to time the Query. They are Today, Today AM, Today PM and Tomorrow.

Disabling Auto Times Button to Specify Time Range:

The Time Range selected using the time selection controls on the Worklist dialog determines that any exam created during that interval, will be retrieved using this Query. The controls give a valid positive Range for the Time Interval*.*

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Two Filters – Date and Time:
The date gives the span of days to search.
The *Time Filter* defines the span to search each day for exams.
If the first change is the *Start or End Date,* this will cause *Start and End Time* to change to 12:00:00 am (start) and 11:59:59 (end). This is the only condition that will cause times to switch to 12 am and 11:59 pm.

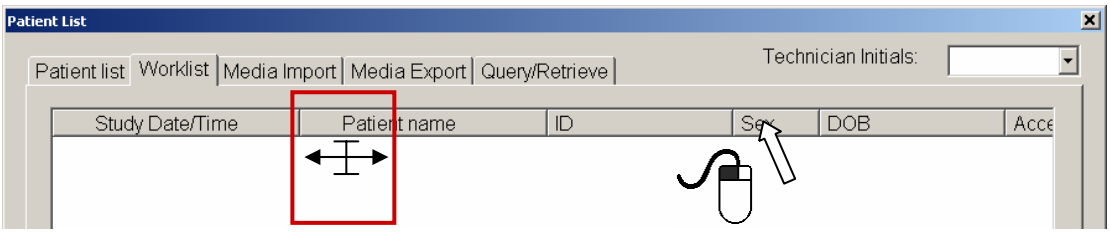
Changing End time to Before Start Time
This will cause *End Time* to go forward one hour instead of backward one hour, unless the *Start Time* is after 11pm. This will cause the *End Time* to go to 11:59:59pm.

If Start and End Time are the Same
Moving Start Time forward one hour will move *End Time* forward 1 hour after the *Start Time*, unless the start time is after 11pm. This will cause the *End Time* to go to 11:59:59pm.

After execution of a *Query*, the patient list of 17 possible fields will display. The user can select from displayed columns in the list by ***right*** clicking *Mouse* over one of the columns. The *Patient Name Field* cannot be hidden.

The user can resize and move the columns.

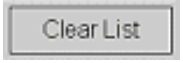
Each header can be sorted by double clicking on the header; providing data in ascending or descending order.



Users can *Import Patients* that are not already imported (according to ID) and patients that are not already displayed on the *Patient List.*

NOTE: The system prevents the same patient from being displayed—having multiple files in our application.

The user can clear all *Current Patients* in the *Worklist Patient List* by pressing the *Clear List* button.



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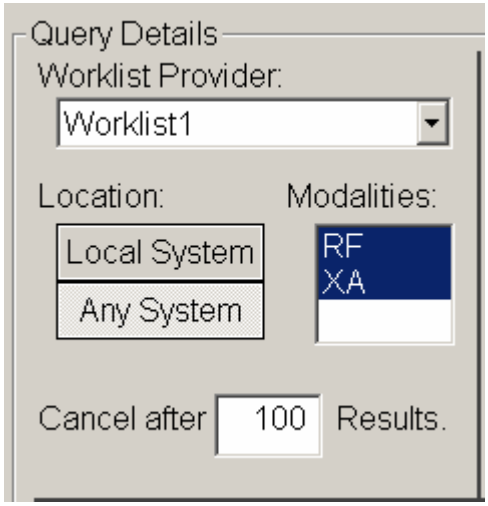
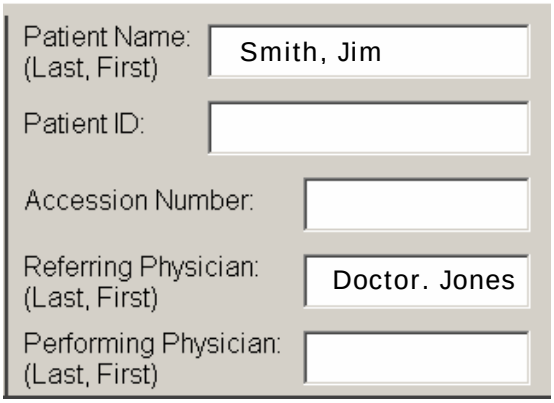


1. Select a database to search:
   Select a *Worklist Provider*.

2. Select *Location*:
   Local System: Specific room
   Any System: Searches DICOM network

3. Select *Modality* to be *Queried*:
   RF: Radio Fluoroscopy (returns only files that contain the RF Modality)
   XA: Angiography (returns only files that contain the XA Modality)

4. Select maximum number of results to be returned for the *Query. Range* is from 1-100.



5. Enter data for which you want to search.

Examples: To *Import a Patient* with the name Jim Smith, type "*Smith, Jim"* in the *Patient Name Field.*

To *Import All Patients* from a referring Physician named Dr. Jones, type "*Dr. Jones"* in the *Referring Physician Field.*

6. It's a good idea to *Verify* that the selected database system is functioning, before trying to run the actual *Query.* Select the *Verify* button.

The system will show the *Status* in the lower right of screen.

7. If the database is functioning, click on the *Execute Query* button to *Run* the *Query.*

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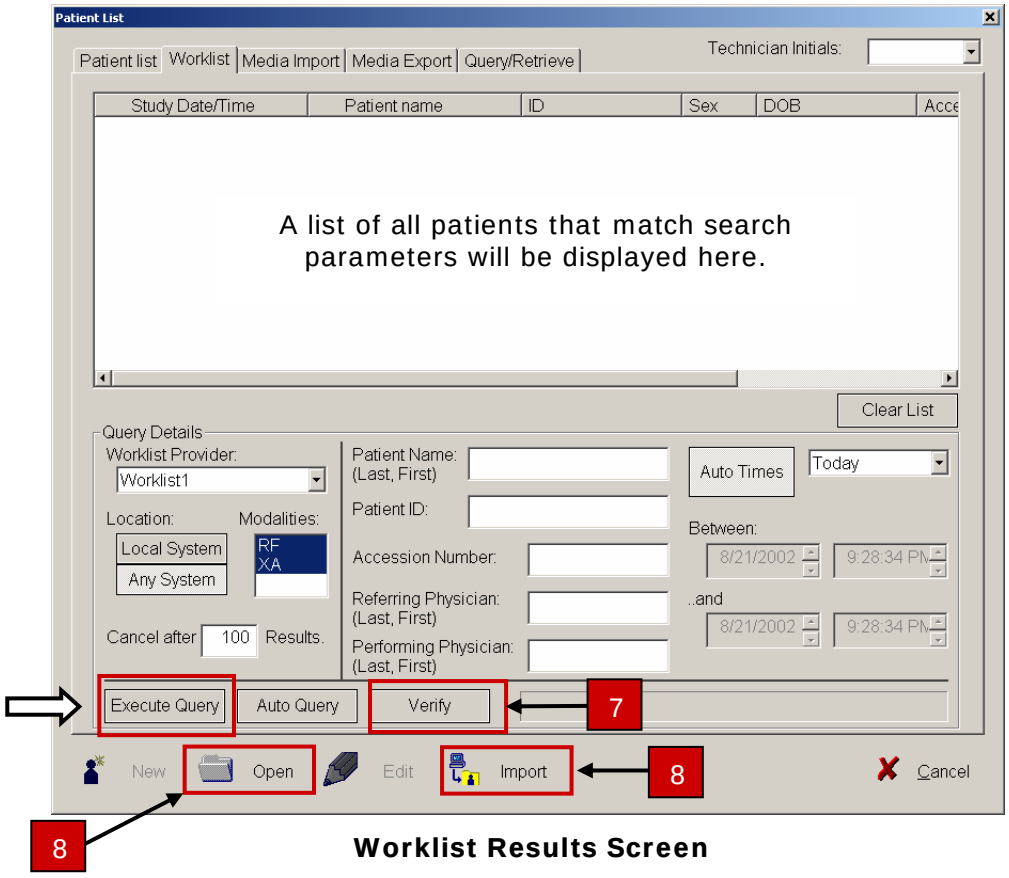

Worklist Results Screen

8. Highlight the preferred patient and then click on the

button.

- The patient information will be imported into the local database, the patient added to the *Patient List*, and the *Patient File* will be opened with *Acquisition Enabled.*
- If the

button is selected instead of the *Open* button, the *Patient File* data will be imported into the database but you will not automatically be brought to the *Acquisition* screen.

The *Worklist* Results information remains on the *Worklist* screen until the *Current Session* is *Closed.*

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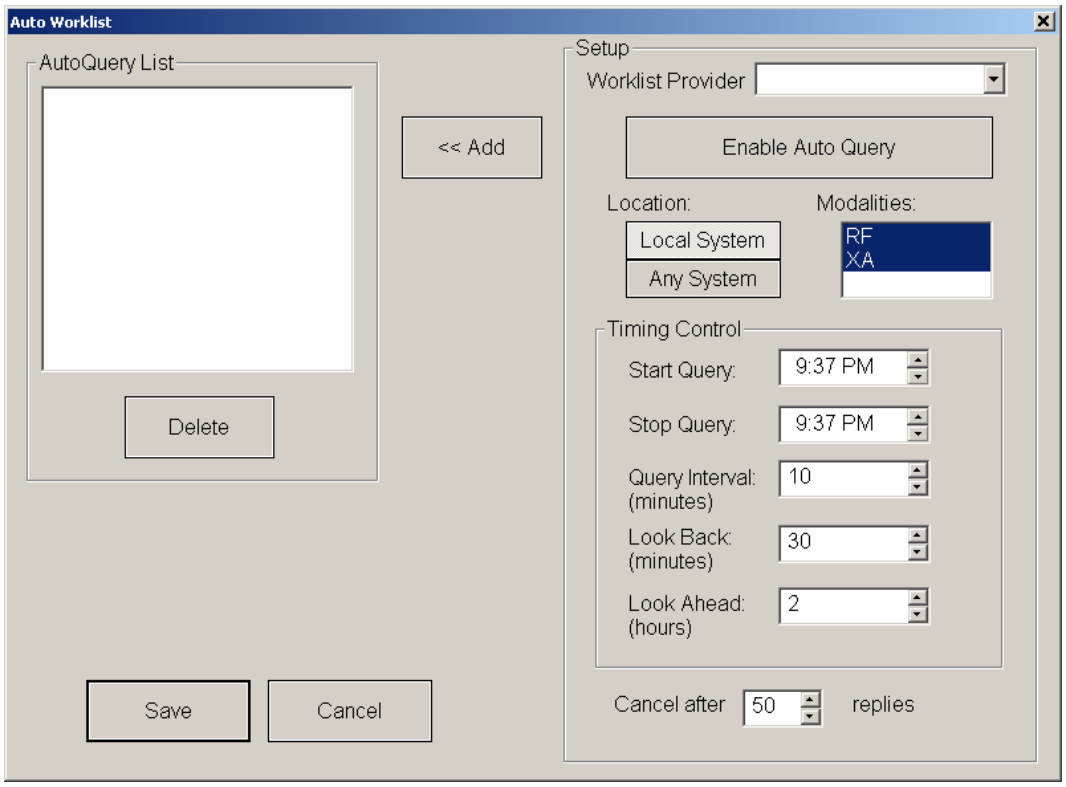
4.1.4.2 Setup Auto Query (Automatic Patient File Search)

Auto Query can be Setup to Run automatically at a specified time. Several details are *Setup* for the ability for Automatically Querying the DICOM Worklist Server. The Worklist Providers are configured from the Service Application.

1. From the Worklist screen, select

button.

2. The Auto Worklist screen will display.



Auto Worklist Screen

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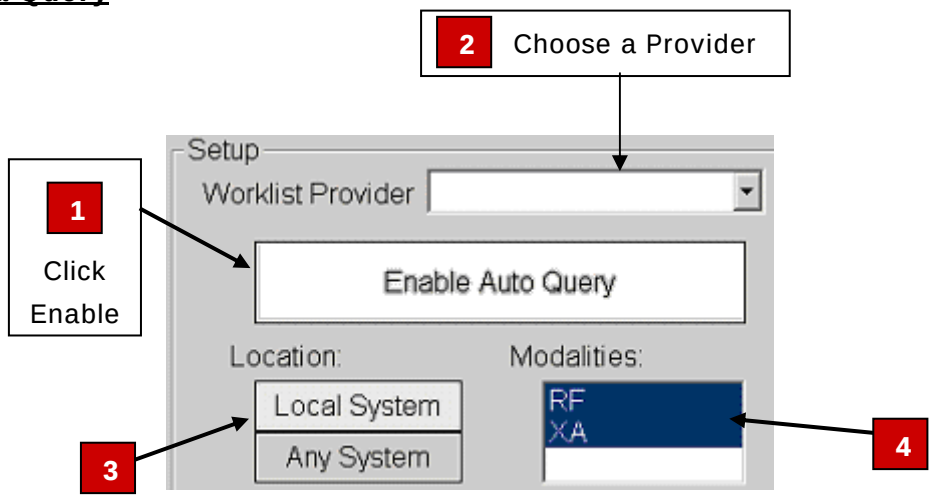
Setting up a Query



1. To *Setup* a *Query*, click *Enable Auto Query* button.
2. Then, select available *Provider* from the *Worklist Provider* selections.
3. Select *Location*: Any System
   Local System: Specific room
   Any System Searches DICOM network
4. Select *Modality* to be *Queried:*

   RF *Radio Fluoroscopy*
   (returns only files that contain the RF modality)

   XA *Angiography*
   (returns only files that contain the XA modality)

5. Click the *Enable Auto Query* button. Then, and set the *Time Parameters* for running *Automatic Queries.*

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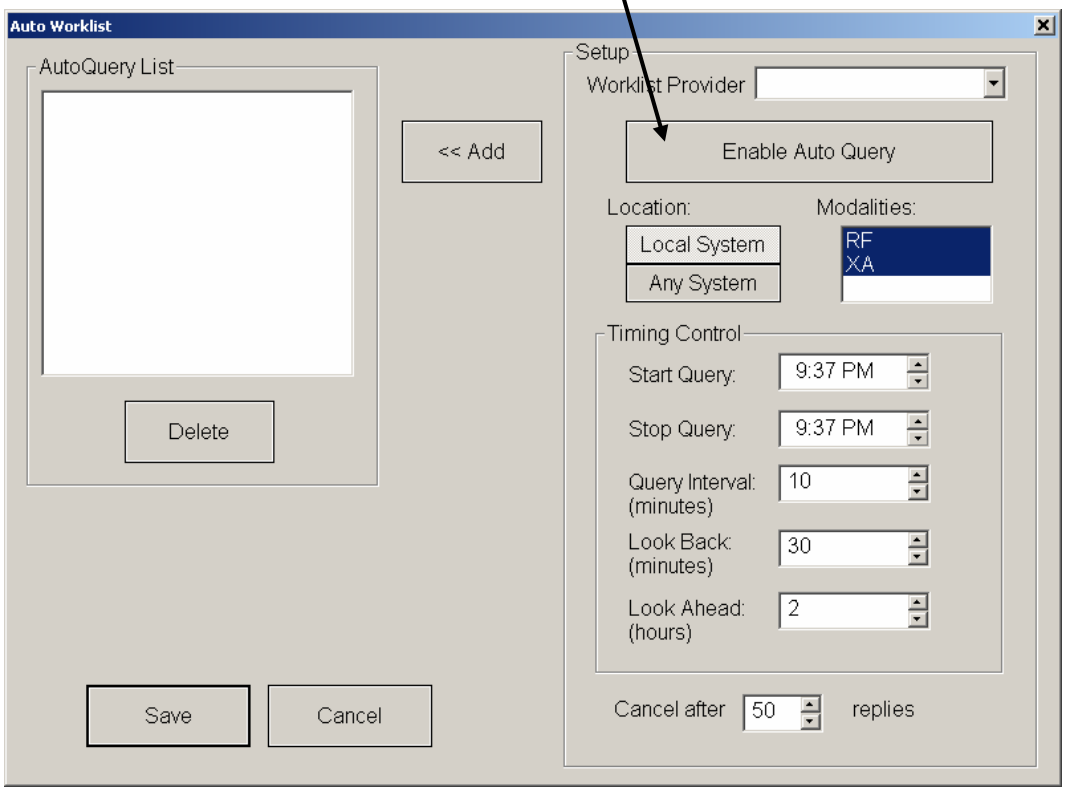
The user will *Enable* or *Disable* an *Auto Query.* It stays highlighted if *Auto Query* is on.



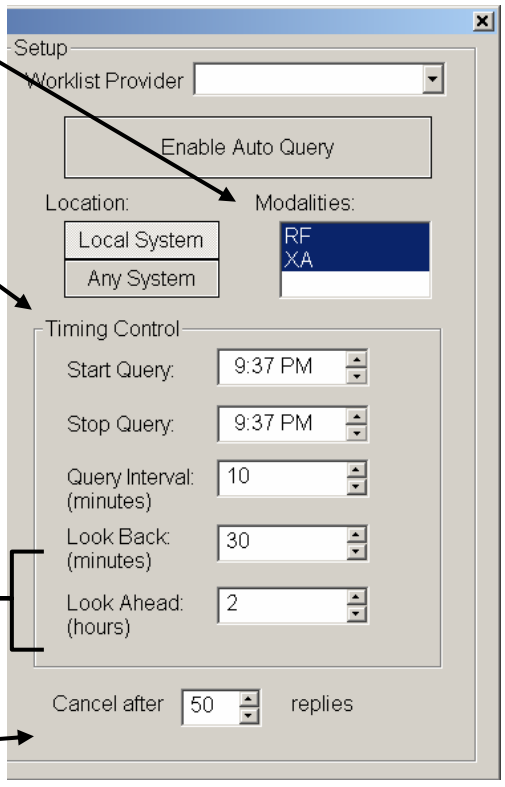
Modalities Selection: *Select RF* (General patient Type), *XA* (Vascular Patient Type), or both as the image *Modalities* to be retrieved using the *Query.*

Timing Control: Specifies Start and Stop Query Times: The *Start Time* must be less than or equal to *Stop Time.* The *Interval* between *Queries* is 5-720 minutes.

Loop Back and Look Ahead Ranges: The *Look Back* and L*ook Ahead Values* determine the *Time Range* of the patient records retrieved with each *Query.*

- *Look Back Ranges* of 0–120 minutes
- *Look Ahead Ranges* of 1–96 minutes

Cancel After: Specifies the number of *Results* after which the *Query* should be terminated. The number can *Range* from 1 to 500.



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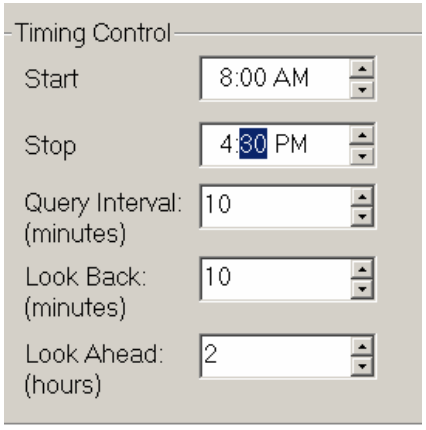
Example: Start Time of the *Query* is 10 AM. The Stop Time is 10 PM. The *Query* Interval is 10 minutes. Set the look back value to 30 minutes and Look Ahead Value to 1 hour. The first *Query* starts at 10 AM and it will retrieve patients created between 9:30 AM to 11 AM. The next Query will start at 10:10 and will use Look Back *a*nd Look Ahead Parameters to retrieve patients created between 9:40 AM and 11:10 AM.

When Time Intervals overlap and the same patient/exam record is retrieved more than once, the records are updated/overwritten with the most recently retrieved data.

The user can save or abandon an Auto Query created or changes made to an existing one respectively. This will only Close the dialog and not turn Off a *Query* that is actively running.

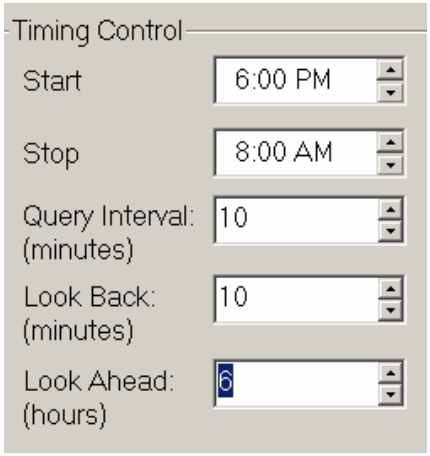


1. Set the Time Parameters for running Automatic Queries.

Example A

To set the system to Automatically Query the Worklist Database for patients scheduled within the next two hours, and to have this Query Run only during business hours, select the following:

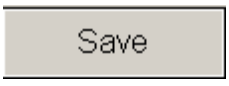
Start Query:	8:00 am
Stop Query:	4:30 pm
Query Interval:	10 minutes
Look Back:	10 minutes
Look Ahead:	2 hours



Example B

To Run Automated Queries during the night for patients scheduled for procedures the next morning, select the following:

Start Query:	6:00 pm
Stop Query:	8:00 am
Query Interval:	10 minutes
Look Back:	10 minutes
Look Ahead:	6 hours



2. Press << Add. The new Auto Query Provider will show on the Auto Query List.
3. Select Save to set the Query. It will begin depending on the Time Parameters set above.

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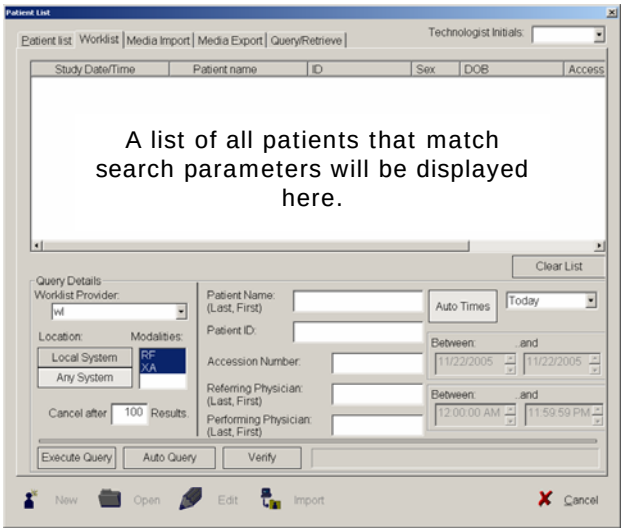


4. After the Query has run, the results will display on the Worklist Results screen. The Worklist will contain all patients scheduled for the time period specified in the search.

5. Highlight the preferred patient and then click on

.

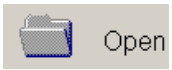
- The patient information will be imported into the local database, the patient added to the *Patient List,* and the *Patient File* will be opened with *Acquisition Enabled.*
- If

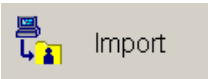
is selected instead of the *Open* button, the patient file data will be imported into the database but you will not automatically be brought to the *Acquisition* screen.
- The *Worklist Results* information remains on the *Worklist* screen until the *Current Session Closed.*

4.1.4.3 Importing Patient Data Using Worklist Feature

Use the *WorkList* feature to search a database (usually a centralized database connected via a DICOM network) for groups of patients based on specific criteria, or a specific Patient file. This feature is used to search by patient data only - not images. If DICOM is not enabled on your system, the *Worklist* tab will not appear on the *Patient List* screen.

<u>One of two methods can be used to import data:</u>

1) Highlight a single patient in the W*orklist* data, then double click, or press the *Open* button, this patient is entered into the *Patient Database* and opened for *Acquisition.* 

2) Highlight several patients in *Worklist* using *Keyboard CTRL Key.* Then select *Import* button to *Import Patients* into the local database and to appear for selection in the *Patient List.* The *Patient File* data will be imported into the database but you will not automatically be brought to the *Acquisition* screen. 

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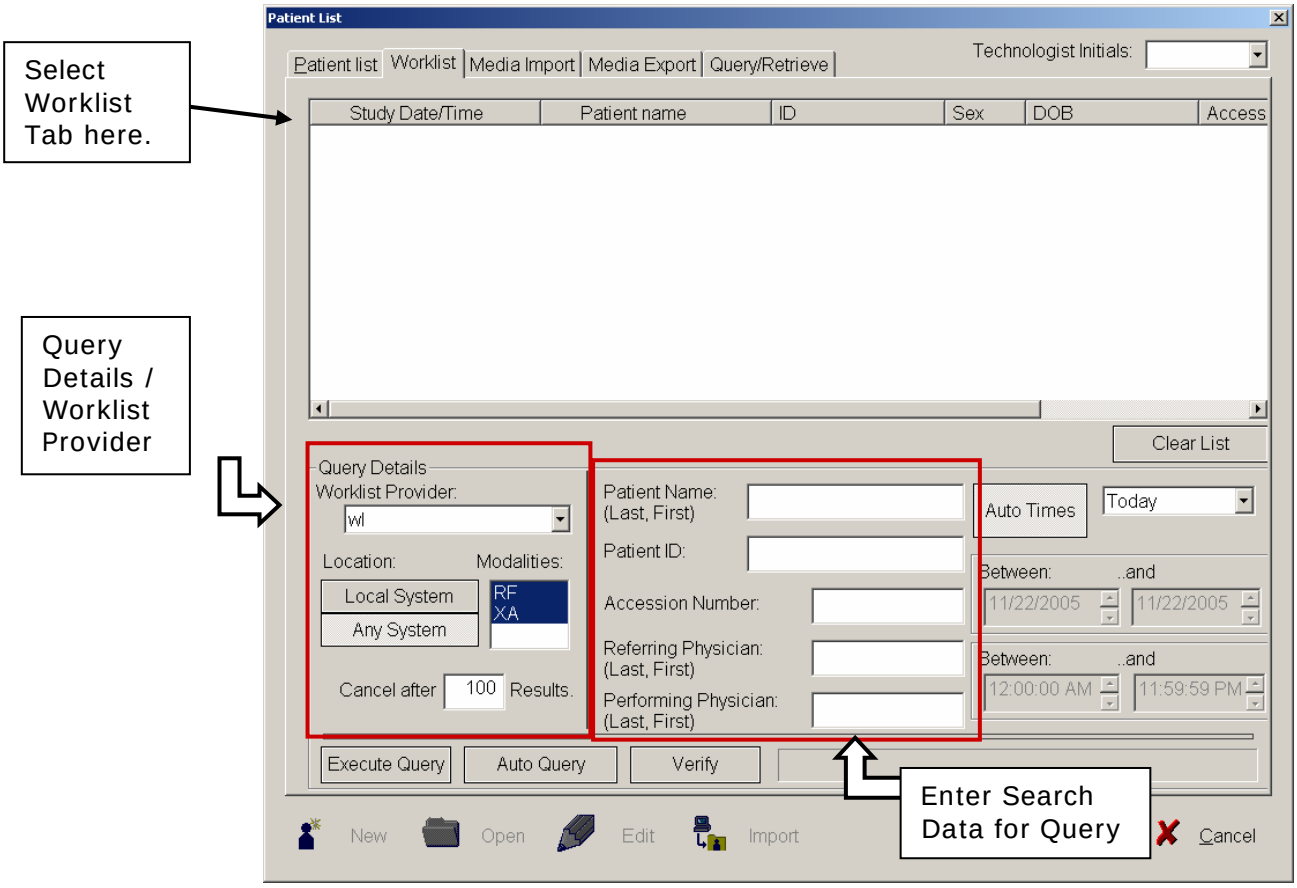
When *Importing Patients* from *Worklist Server*, three descriptions that could be loaded as the *Study Description* are:

Scheduled Procedure Description (DEFAULT)
Scheduled Procedure Step ID
Requested Procedure Description

The three descriptions loaded into the *Description Field* during an *Import* are configurable. The *Patient Description Source* option is located in a registry key called """*Patient Description Source*""" located at: """\Orion\Dicom\Worklist\Modalities\""".

This key is a DWORD. If this key is not found, then the *Default Study Description* (which is the *Scheduled Procedure Description*) will be used.

4.1.4.4 Manual Search for a Specific Patient



Worklist Screen

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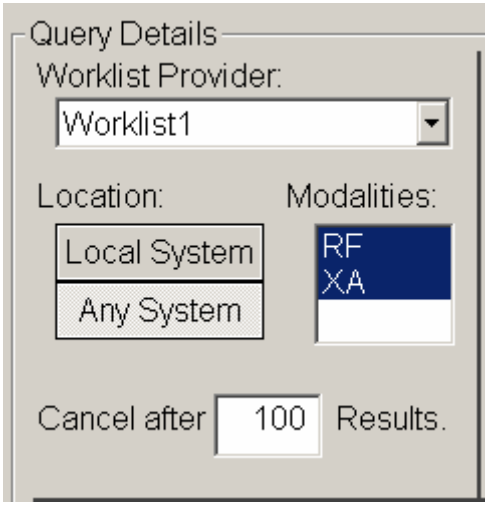


1. Select a database to search (called – *Provider*).

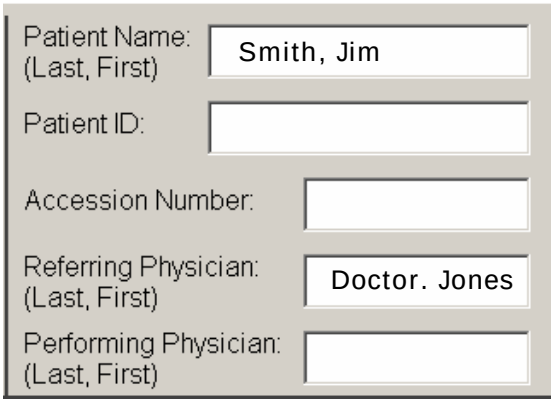
2. Select *Location*:
   Local System: Specific room
   Any System Searches DICOM network

3. Select *Modality* to be *Queried:*

   RF *Radio Fluoroscopy* (returns only files that contain the RF modality)

   XA *Angiography* (returns only files that contain the XA modality)

4. Select maximum number of *Results* to be returned for the *Query*. Range is from 1-100.



5. Enter data for which you want to search.

Examples: To *Import a Patient* with the name Jim Smith, type "*Smith, Jim"* in the *Patient Name field.*

To *Import All Patients* from a referring Physician named Doctor. Jones, type "*Doctor. Jones"* in the *Referring Physician field.*

6. Before trying to *Run* the actual *Query, Verify* that the selected database system is functioning. Select Verify. The system will show the *Status* in the lower right of *Edit* box.

7. If the database is functioning, click Execute Query to run the *Query.*

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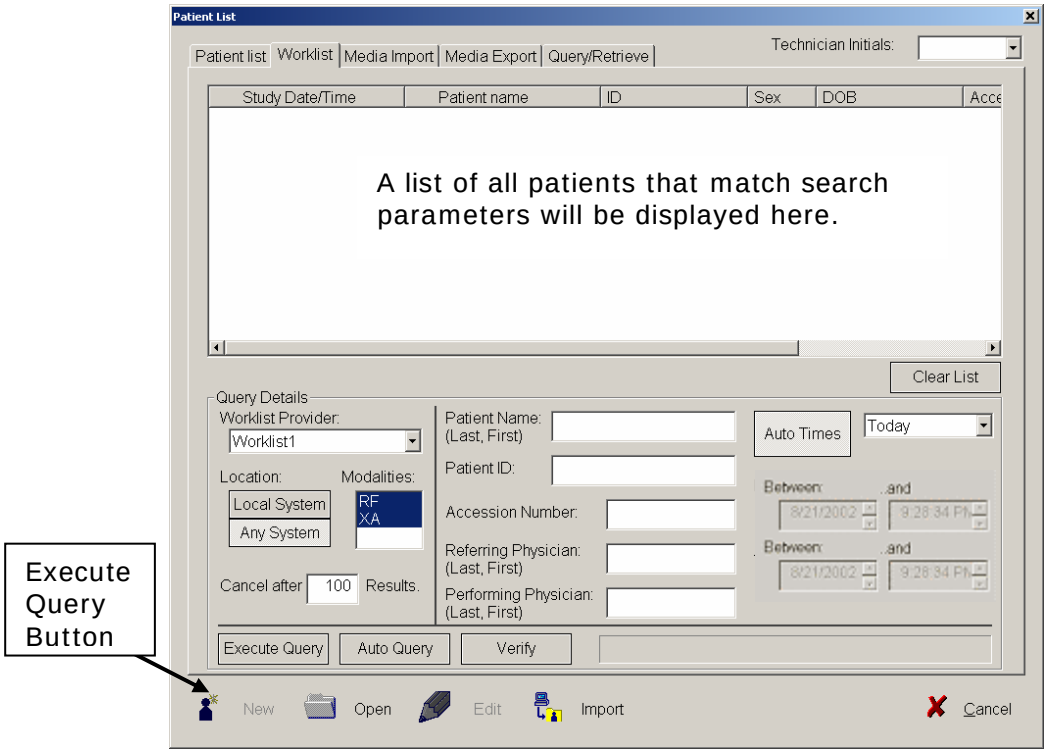

Worklist Results Screen

Import the Patient:

There are Two Methods to Import Patients to the Current System:

1. Highlight the preferred patient and then click the

button.

   The patient information will be imported into the local database, and the *Patient File* will open with *Acquisition* enabled.

2. Highlight the preferred patients and click the

button.

   The *Patient File* data will be imported into the database but you will not automatically be brought to the *Acquisition* screen.

The *Worklist* results information remains on the *Worklist* screen until the *Current Session* is *Closed.*

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4.1.5 Close a Patient File

In order to *Open a New Patient File,* the *Current File* must be closed - only one *Patient File* can be open at a time. When a *Patient File* is open, the *Main Image* screen will display pertinent patient data in the upper left corner.

When a Patient File is Closed that file will no longer be in use. Even images being transferred to another device are considered not in use. Transferring images are considered to be in the background, and the file is considered Closed and not in use.

Patient List Button

- Select the Patient List button. When a different Patient File is selected, the Current Patient File will be Closed

  A Prompt will display asking for confirmation of the Close Patient File Request.

Close Button

- Select the Close button. A Prompt will display asking for confirmation of the Close Patient File Request.

  If no Patient File is open when the Close button is selected, the system will consider this a Shutdown Request.

  The system will ask for confirmation of this request.

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4.2 SET DOCTOR PREFERENCES

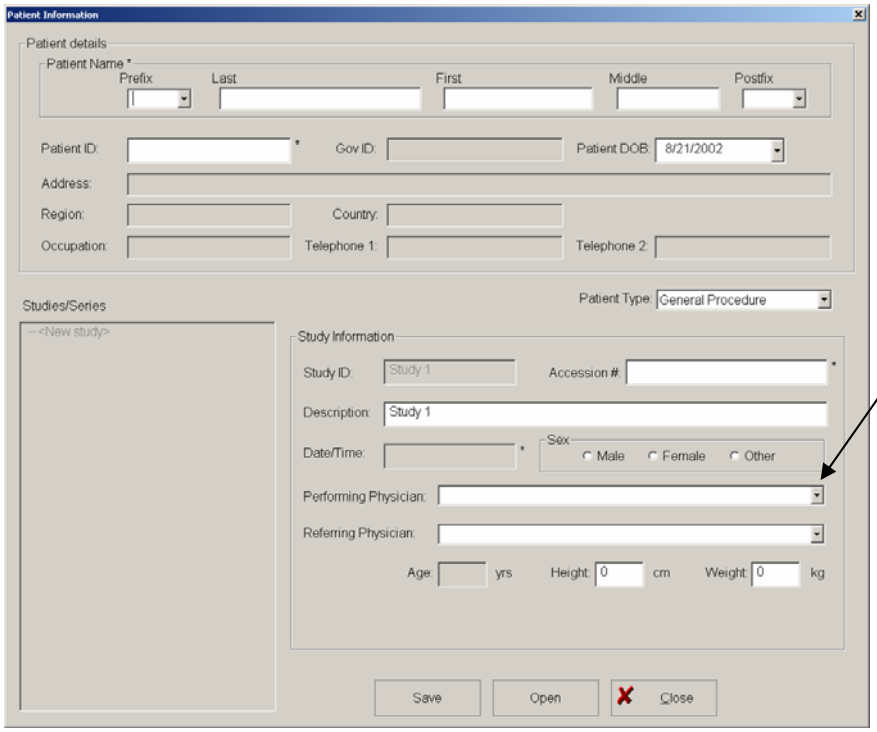
This feature allows a site to define certain parameters for individual Doctors to further automate the image acquisition functionality. This feature is called *Doctor Preferences*.

Whenever a Physician is selected as the *Performing Physician* for a patient, the system will automatically use the Physician configured settings for image Acquisition, Review, Printing, and Network Transfer.

In order for the feature to work the Doctor's preferences have to be programmed into the system. If no Preferences are entered, the DIS will use default the system Doctor Preferences and settings.

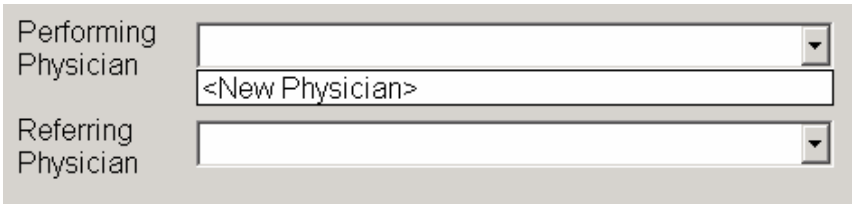
Refer to Chapter 4.3 on Configuring doctor preferences.

4.2.1 Add New Physician



1. Select .
2. Select a new or existing patient file.
3. Click on Down arrow for Performing Physician.

The resulting menu will show all physicians currently established and a ***<New Physician>*** option.



4. Select the ***<New Physician>*** option.
5. The Physician Name Editor screen will open.

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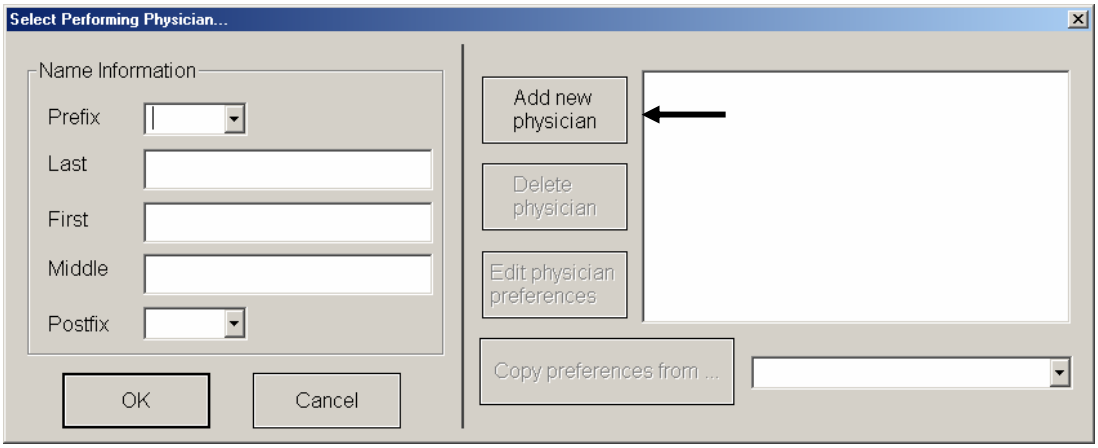

New Physician Name Screen

6. Enter Physician's name, using drop down menu boxes for Prefix and Postfix or type in new ones.
7. Click on "Add New Physician" button and the doctor's name is added to the list.
8. Repeat these steps to add other physicians to the list.

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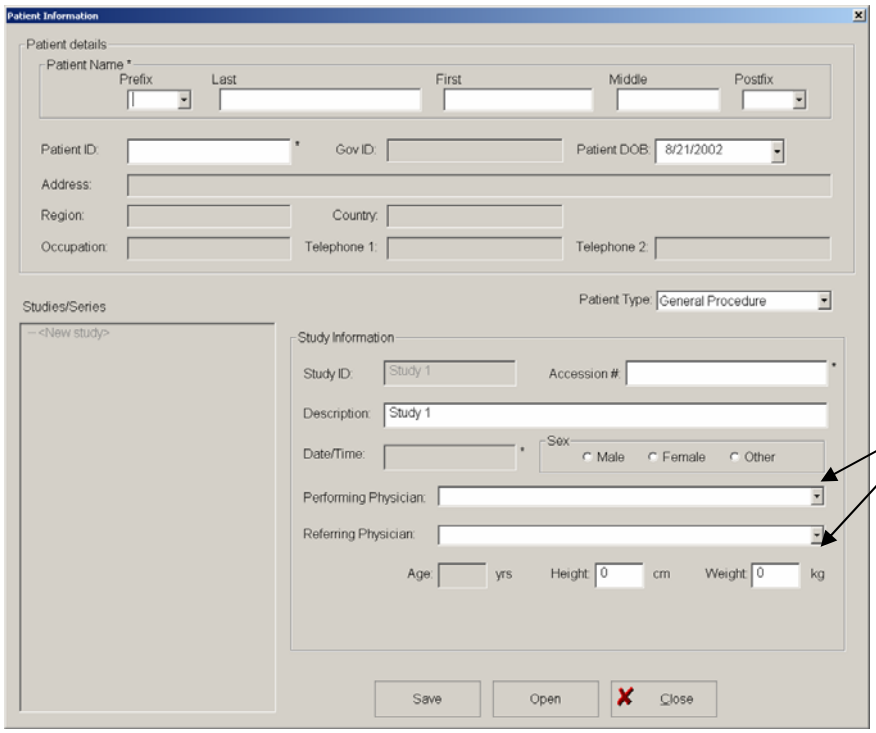
4.2.2 Delete a Physician



1. Select .

2. Select a new or existing patient file.

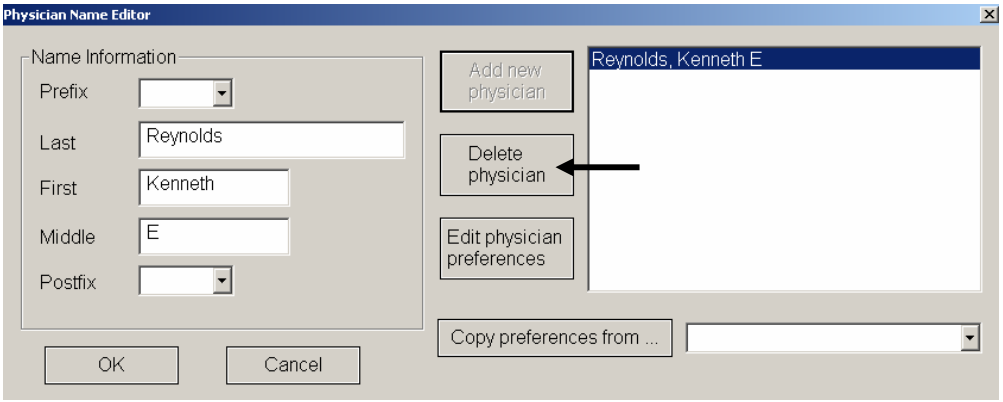
3. Click on Down arrow for either Performing or Referring Physician.

The resulting menu will show all physicians currently established and a ***<New Physician>*** option.

4. Select the New Physician option.

The Physician Name Editor will display.

5. Highlight the Doctor's name from the list of those available.



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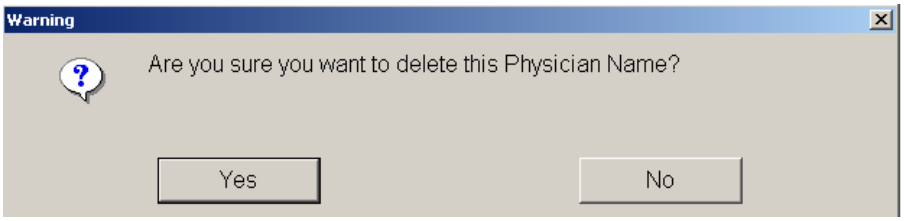
6. Select the **Delete physician** button.
7. You will be prompted to confirm this selection. Click Yes to permanently remove the specified physician or No to cancel the transaction.



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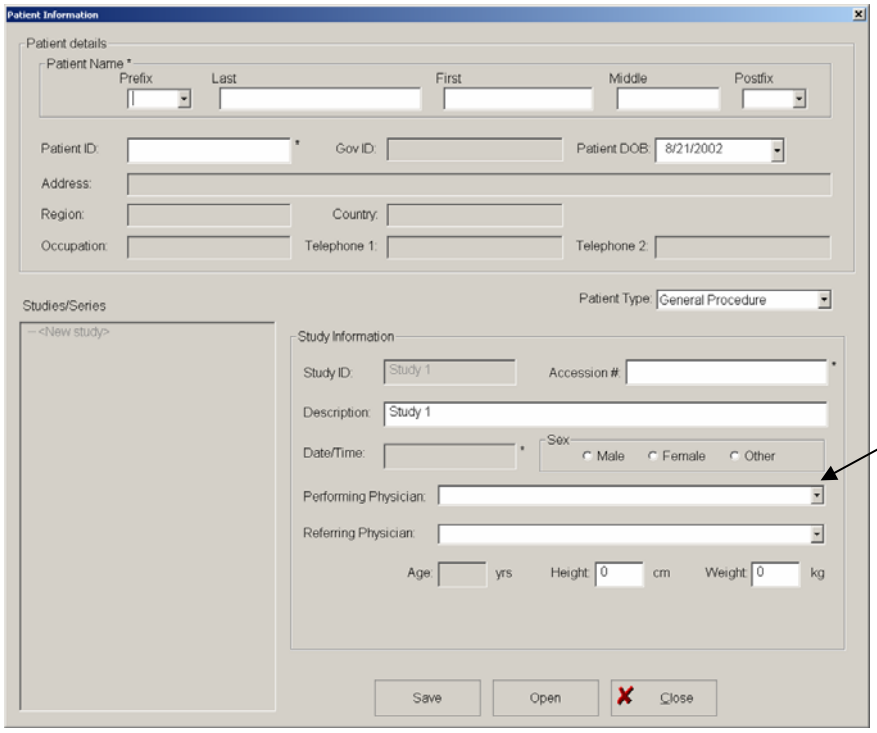
4.2.3 Setting Doctor Preferences



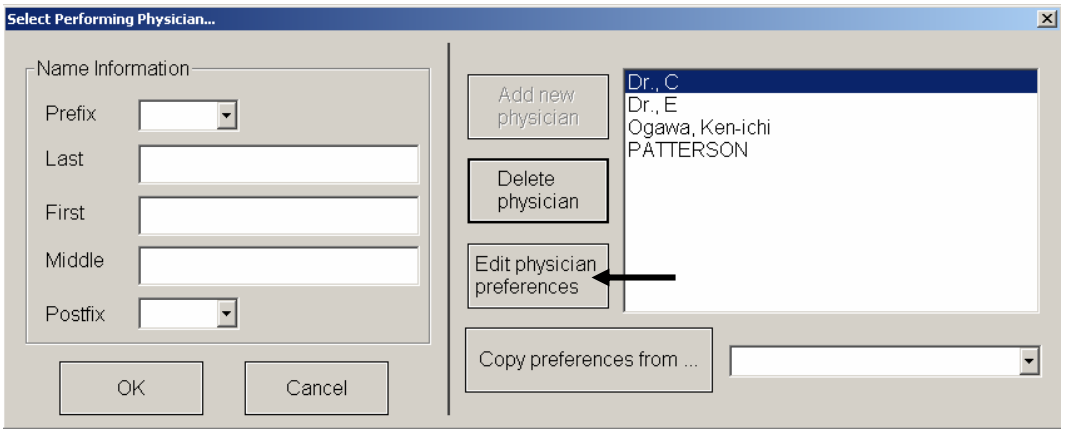
1. Select .

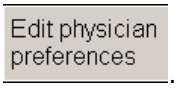
2. Select a new or existing patient file.

3. Click on Down arrow for Performing Physician.

The resulting menu will show all physicians currently established and a ***<New Physician>*** option.
Select the **<New Physician>** option. The **<Physician Name Editor>** will display.

4. Highlight the Doctor's name from the list of those available.



5. Select  .
6. The ***Doctor Preferences*** screen will display.

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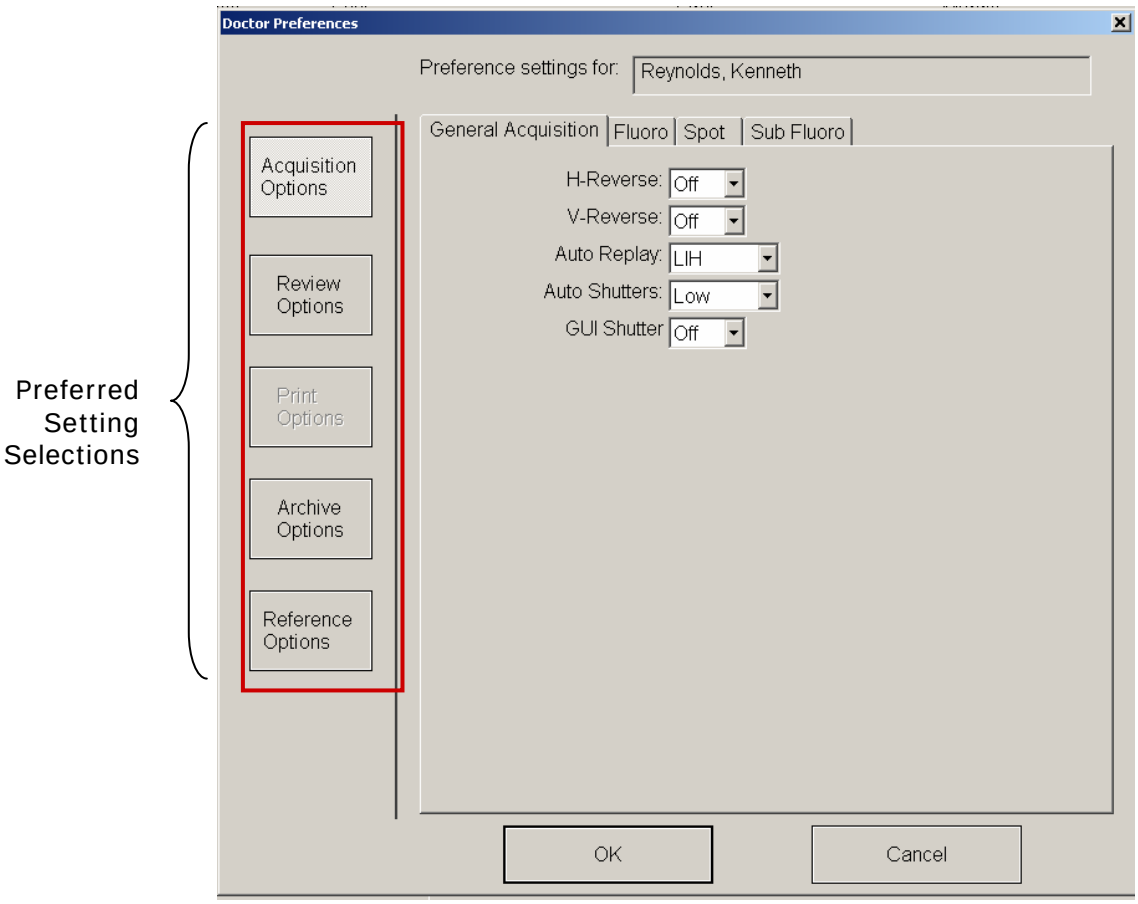

Doctor Preferences Edit Screen

7. Select each of the buttons on the left to select the preferred settings for each mode: **Acquisition**, **Review**, **Archive**, & **Reference** (each setting is described in detail in the following Chapter 4.3).
8. When settings are complete, select **OK**.
9. The **Doctor Preferences** screen will close and return to the **Physician Name Editor** screen.
10. Repeat steps 1-9 to set the preferences for a different Doctor and when the process is complete, select **OK**.

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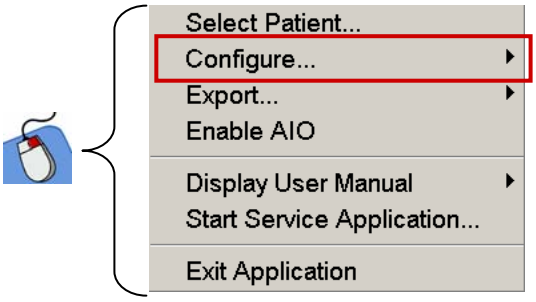
4.3 CONFIGURING DOCTOR PREFERENCES

The Doctor Preference screen offers a series of tabs that allow specific settings to be made for General Acquisition, Review, Reference Display, Printing and Archive Transfer as well as Fluoro, Spot and Sub-Fluoro. For instructions on setting up a new physician, editing an existing physician or deleting a physician, refer to Chapter 4.2 *Set Doctor Preferences.*

NOTE: Current Doctor Preferences opens the ***Doctor Preferences*** screen where settings can be changed for the specific physician.

Use these instructions to set or change the Doctor Preference settings.

1. Right-click the pointing device while the cursor is over the image display area. A drop-down menu will display:

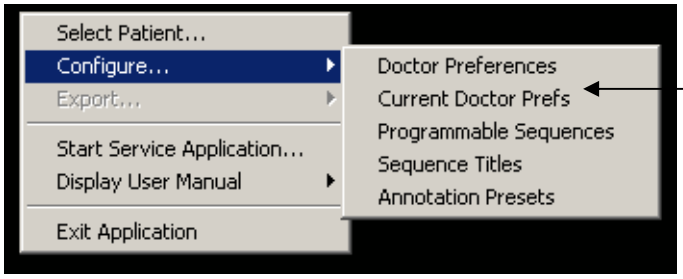


NOTE: The *Enable AIO*

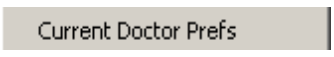
option is only available while ***right*** clicking on a *Spot* image.

2. From the available choices, click on

. The custom configuration sub-menu will display.



3. Click on **Doctor Preferences** to establish new preferences, or click on **Current Doctor Prefs** to view or change current Doctor Preferences.

NOTE: The *Current Doctor Prefs* 

option is only available while ***right*** clicking on a *Spot* image.

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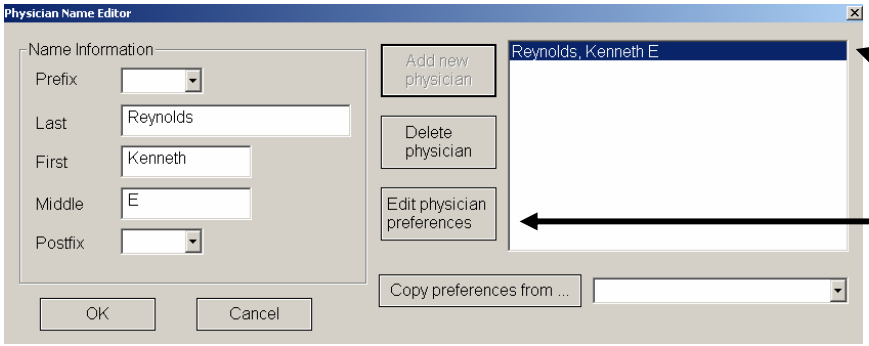
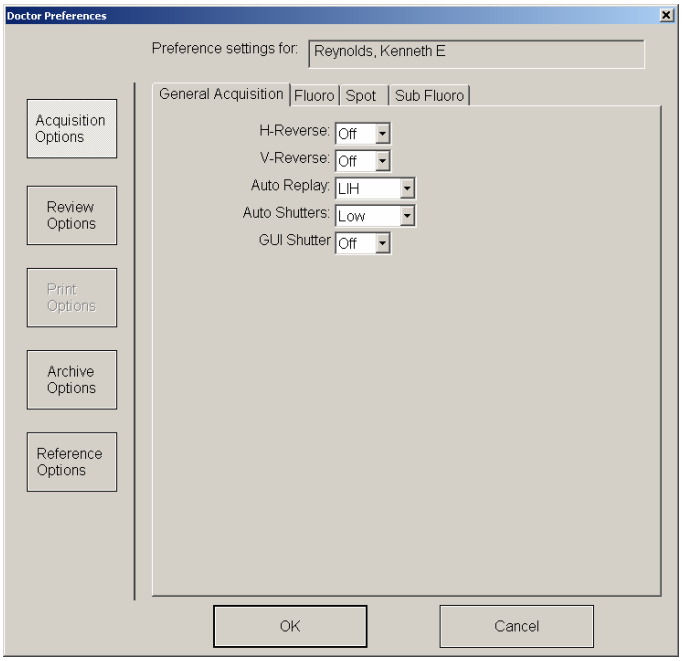
4. The ***Physician Name Editor*** window will display.



5. To make changes, highlight the doctor's name, and then click the **Edit Physician preferences** button.

   To add a new Doctor, enter the Dr.'s name, and then select the **Add new physician** button. Refer to Chapter 4.2 *Set doctor preferences* for complete instructions on adding new physicians.



When adding a new doctor to the list, use the preferences already established for another doctor by selecting the **Copy Preferences From** drop down list.

6. The ***Doctor Preference*** screen will display.

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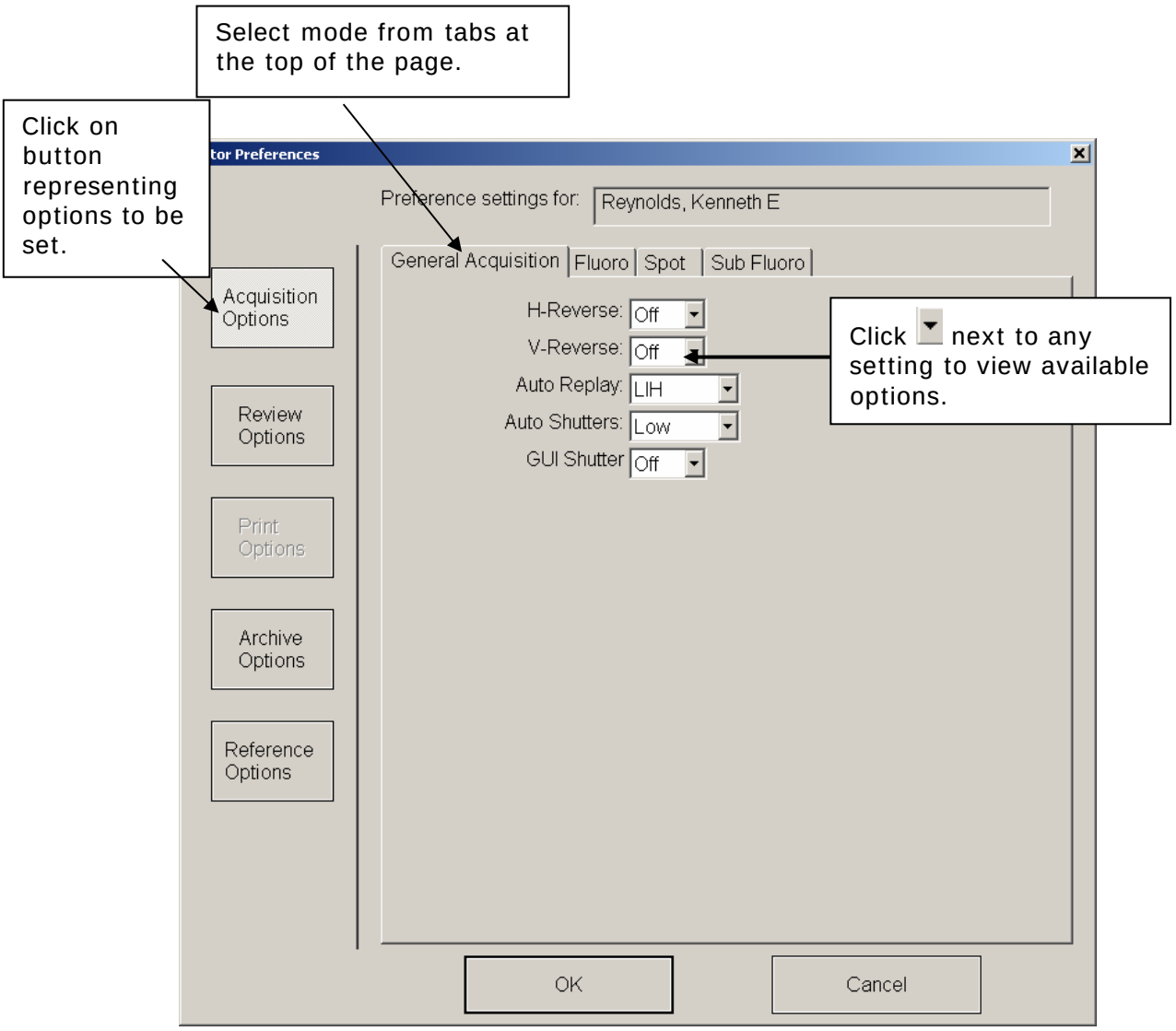

Doctor Preferences Feature Menu

The default screen is Acquisition Options, General Acquisition tab. Steps 4.3.1 – 4.3.5 describe the Options and the settings available.

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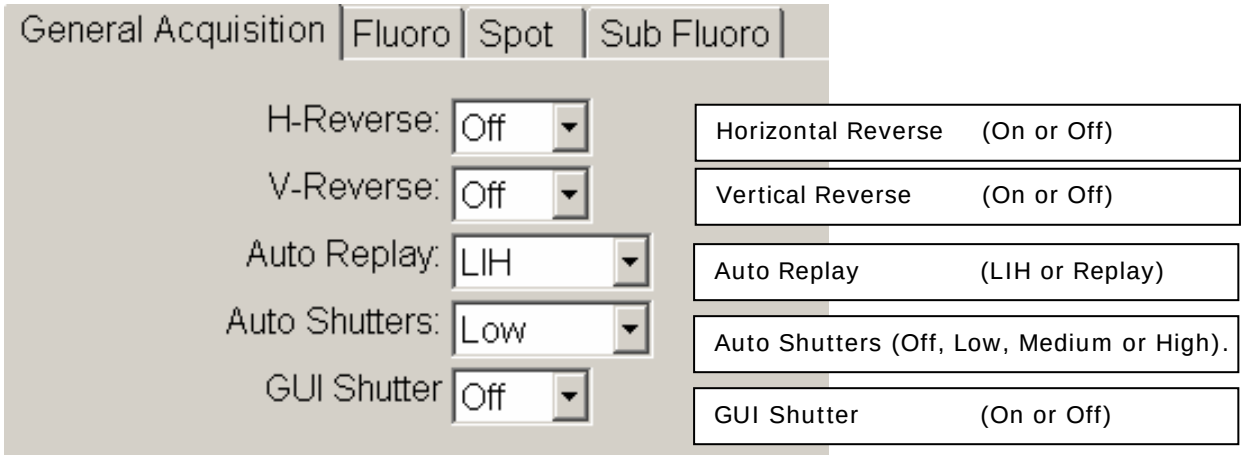
4.3.1 Acquisition Options

4.3.1.1 General Acquisition Mode - Doctor Preferences



General Acquisition	**Horizontal and Vertical Image Reversal**: The H-Reverse and V-Reverse buttons are used to control the orientation of the image acquisition. The next acquired image will be reversed based on the H-Reverse and V-Reverse configuration. If either of these is turned on while the system is in the Review mode, the orientation of the current image will not be changed, but the system will reverse the next acquired image.
	Auto Replay: Choose to either hold the last image acquired (Last Image Hold - LIH) or for the system to automatically replay the sequence of images (Auto Replay).
	Auto Shutters: The system can be set to look for the image boundary and extend the black surrounding shutter to a few pixels beyond that point. Shutter Setting relates to how far the shutter extends once an edge is detected: low (few pixels), medium (more pixels), or high (several pixels). Off Low Medium High
	GUI Shutter: During acquisition the icons/controls on left side of screen can be dimmed. This is considered “GUI Shutters ON”. If the GUI Shutter is OFF, nothing will happen on the left side of the screen.

To save settings and exit Doctor Preferences…	Click OK at the bottom of the screen	OK
To cancel setting and reset default…	Click Cancel at the bottom of the screen	Cancel

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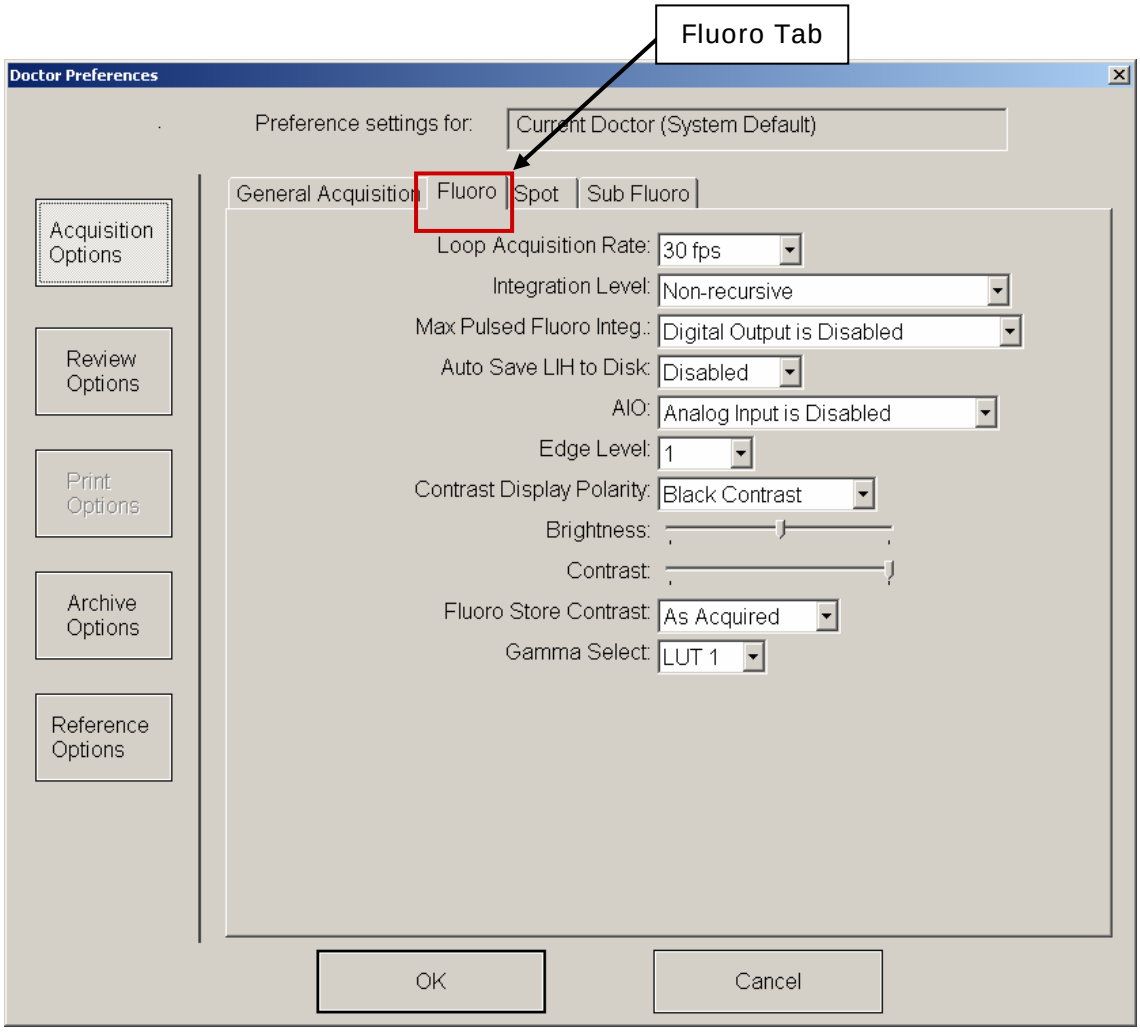
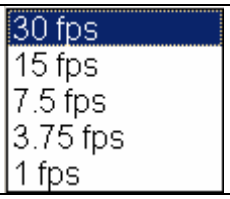
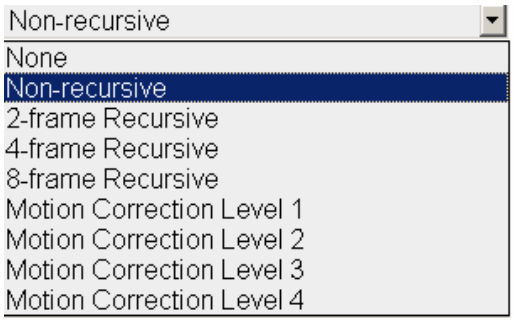
4.3.1.2 Fluoro Mode – Doctor Preferences



Fluoro	**Loop Acquisition Rate:** Select the desired acquisition **Rate** using the pull-down list. 
	Integration Level (or Real Time Noise Reduction): Select the desired level of Integration <u>before</u> applying radiation since the level of filtering reflects the amount of noise reduction during the real-time display, thus affecting the resolution of the stored image. 

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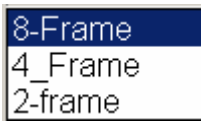
Recursive refers to the system's ability to apply noise reduction to current frame as well as frame(s) prior to it.

The Integration setting is not adjustable for images after they are acquired.

Select the desired Integration level using the pull-down list.

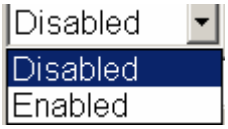
MAX Pulsed Fluoro Integ:

Maximum allowed Integration level. Click to select the desired integration level using the pull-down list.



Auto Save LIH to Disk:

Click to enable or disable this function from drop-down menu. If this is "Disabled" the Last Image on the screen will **not** be saved to the disk displayed.



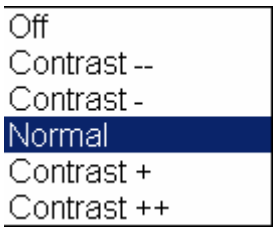
AIO:

The **Auto Image Optimization** feature optimizes the contrast range and selects appropriate Window and Level values for an image as it is acquired.

If the feature is installed but not enabled, the system will use the Default Window, Level, and Display Lookup Tables (Display Lookup Tables are used to select the amount of Contrast for an image).

If the feature is installed and enabled, click for drop-down menu to select the desired AIO level.

NOTE: AIO is NOT available to Fluoro images.

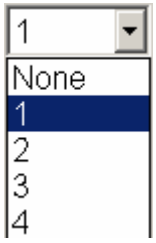


Edge Level:

Select the desired level of Edge Enhancement. The higher the level of Edge Enhancement applied, the sharper the contrast within the image.

There are five possible settings: None, 1, 2, 3, and 4. A higher setting equates to more filtering. Desired setting is site and viewer dependent.
The active Edge setting (by image type) will remain active for subsequent image acquisition or image review until changed.

Click for drop-down menu to select the desired Edge level



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Contrast Display Polarity:
The *Contrast Display Polarity* button changes the *Polarity* of an image from a black *Contrast* image into a white *Contrast* image or vice versa.

Black Contrast: Black background display for current image.

White Contrast: White background display for current image.

Brightness:
Auto-Image Optimization (AIO) is recommended for all unsubtracted image types. However, in the absence of AIO, the default Brightness setting can be configured for each image type within Doctor Preferences.

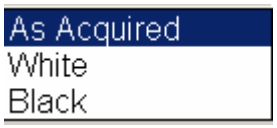
Use slider control to select the default Fluoro Brightness value.

AIO does not apply to spot image.

Contrast:
Auto-Image Optimization (AIO) is recommended for all unsubtracted image types. However, in the absence of AIO, the default Contrast setting can be configured for each image type within Doctor Preferences.

Use slider control to select the default Fluoro Contrast value.

Fluoro Store Contrast:
Use this feature to store fluoro images with a desired contrast. This feature works in conjunction with Contrast display polarity.



Select one of the following settings from drop-down menu

As Acquired: Image will be stored with contrast defined for acquisition

White: Image will be stored with White Contrast

Black: Image will be stored with Black Contrast

Gamma select:

This feature allows for more advanced Customization of LUTs (Display Lookup Table) by offering five different Programmable LUT selections.

Normally, the Default LUTs are adequate and this tool is not normally needed in most Clinical Applications.

To use this feature, click for Drop-down menu to select the desired Gamma Level: LUT 1, LUT 2, LUT 3, LUT 4 and LUT 5.

To save settings and exit Doctor Preferences…	Click OK at the bottom of the screen	OK

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To cancel setting and reset default…	Click Cancel at the bottom of the screen	Cancel

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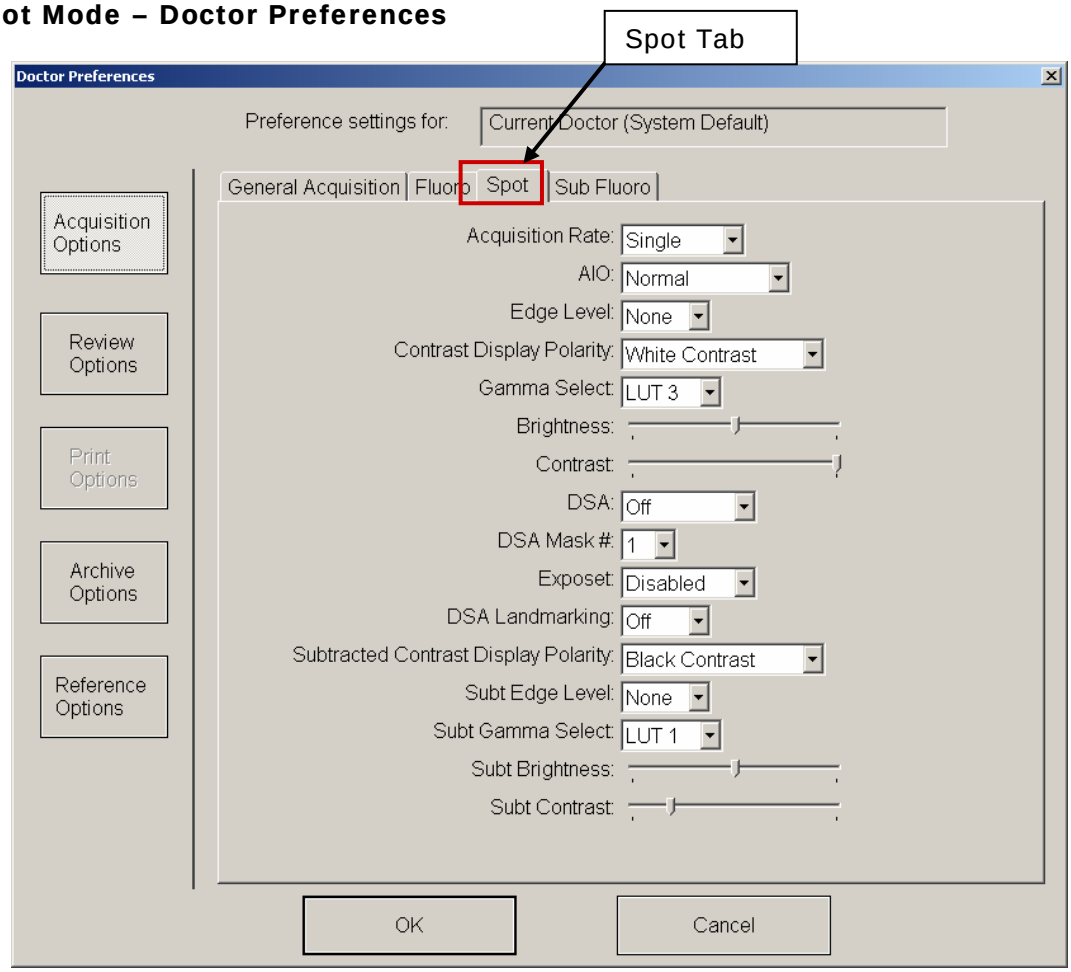
4.3.1.3 Spot Mode – Doctor Preferences



Spot	**Acquisition Rate:** Select a value from the **RATE** pull-down list to control the rate at which images are acquired. Click ▼ to select rate from drop-down menu.	Single Single 0.5 FPS 1 FPS 2 FPS 3 FPS 4 FPS 5 FPS 6 FPS 7.5 FPS 10 FPS 15 FPS

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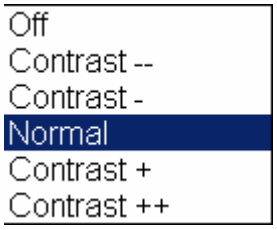
AIO:

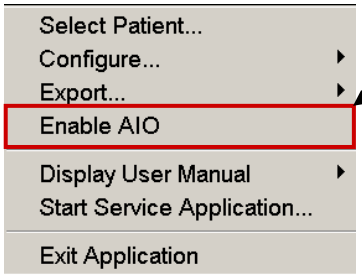
The Auto Image Optimization feature optimizes the Contrast range and selects appropriate Window and Level Values for an image as it is acquired.

If the feature is installed but not enabled, the system will use the Default Window, Level, and Display Lookup Tables (Display Lookup Tables are used to select the amount of Contrast for an image).

Click ▼ for Drop-down menu to select the desired AIO Level.

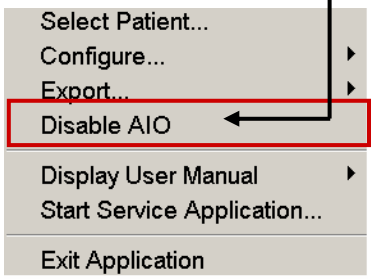


If AIO has been configured for image Acquisition in Review mode, you can turn Off Image Optimization from the Main Image screen using the **Right** click menu.



To enable *AIO,* position *Cursor* over Enable AIO and left click.

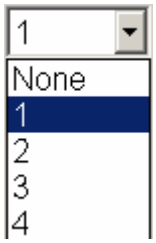
The menu will change to reflect this change.



If AIO is not Enabled when performing image Acquisition, the Enable/Disable AIO button will not appear on the **Right** click menu.

Edge Level:

Select the desired level of Edge Enhancement. The higher the level of Edge Enhancement applied, the sharper the contrast within the image.



There are five possible settings: None, 1, 2, 3, and 4. A higher setting equates to more filtering. Desired setting is site and viewer dependent.

The active Edge setting (by image type) will remain active for subsequent image acquisition or image review until changed.

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Contrast Display Polarity:
The Contrast Display Polarity button changes the Polarity of an image from black Contrast image into a white Contrast image or vice versa.

Black Contrast: Back background display for current image.

White Contrast White background display for current image.

Gamma Select:

This feature allows for more advanced Customization of LUTs by offering five different Programmable LUT selections.

Normally, the Default LUTs are adequate and this tool is not normally needed in most Clinical Applications.

To use this feature, click for Drop-down menu to select the desired Gamma Level: **Linear, Contrast +, Contrast + +, Contrast - and Contrast - -.**

Brightness:
Use slider control to select the default Fluoro Brightness value. This will only be applied if AIO for the Fluoro image type is OFF.

Contrast:
Auto-Image Optimization (AIO) is recommended for all unsubtracted image types. However, in the absence of AIO, the default Contrast setting can be configured for each image type within Doctor Preferences.

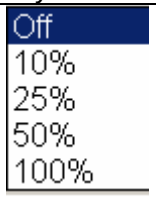
Use slider control to select the default Spot Contrast value. This will only be used if AIO is OFF.

DSA
Use drop-down menu to turn DSA on or off on this system

DSA Mask #
Use drop-down menu to select mask # from those available – 1, 2, 3, 4, 5, 6, 7, 8, 9.

Exposet
Use drop-down menu to enable or disable Exposet on this system.

DSA Landmarking
Use drop-down menu to turn Landmarking on or off on this system



Click to select the desired percentage (%) setting from drop-down menu

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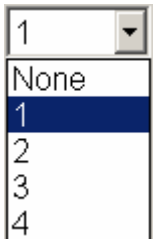
Subtracted Invert:
The **INVERT** button changes the polarity of the subtracted image from a positive image into a negative image or vice versa.
On: Image polarity will be inverted as shown on screen to be white on black.
OFF: Acquired images will not be inverted.

Subtracted Edge Level:
Select the desired level of Subtracted Edge Enhancement. The higher the level of Edge Enhancement applied, the sharper the contrast within the subtracted image.

There are five possible settings: None, 1, 2, 3, and 4. A higher setting equates to more filtering. Desired setting is site and viewer dependent.

The active Subtracted Edge setting (by image type) will remain active for subsequent image acquisition or image review until changed.



Subtracted Gamma select:

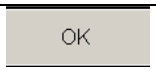
This feature allows for more advanced Customization of LUTs by offering five different Programmable LUT selections.

Normally, the Default LUTs are adequate and this tool is not normally needed in most Clinical Applications.

To use this feature, click on for *Drop-down* menu to select the desired Gamma Level: Linear, Contrast +, Contrast + +, Contrast - and Contrast - -.

Subtracted Brightness:
Use slider control to select the subtracted Brightness value.

Subtracted Contrast:
Use slider control to select the subtracted Contrast value.

To Save settings and exit Doctor Preferences…	Click OK at the bottom of the screen	
To Cancel settings and reset default…	Click Cancel at the bottom of the screen	

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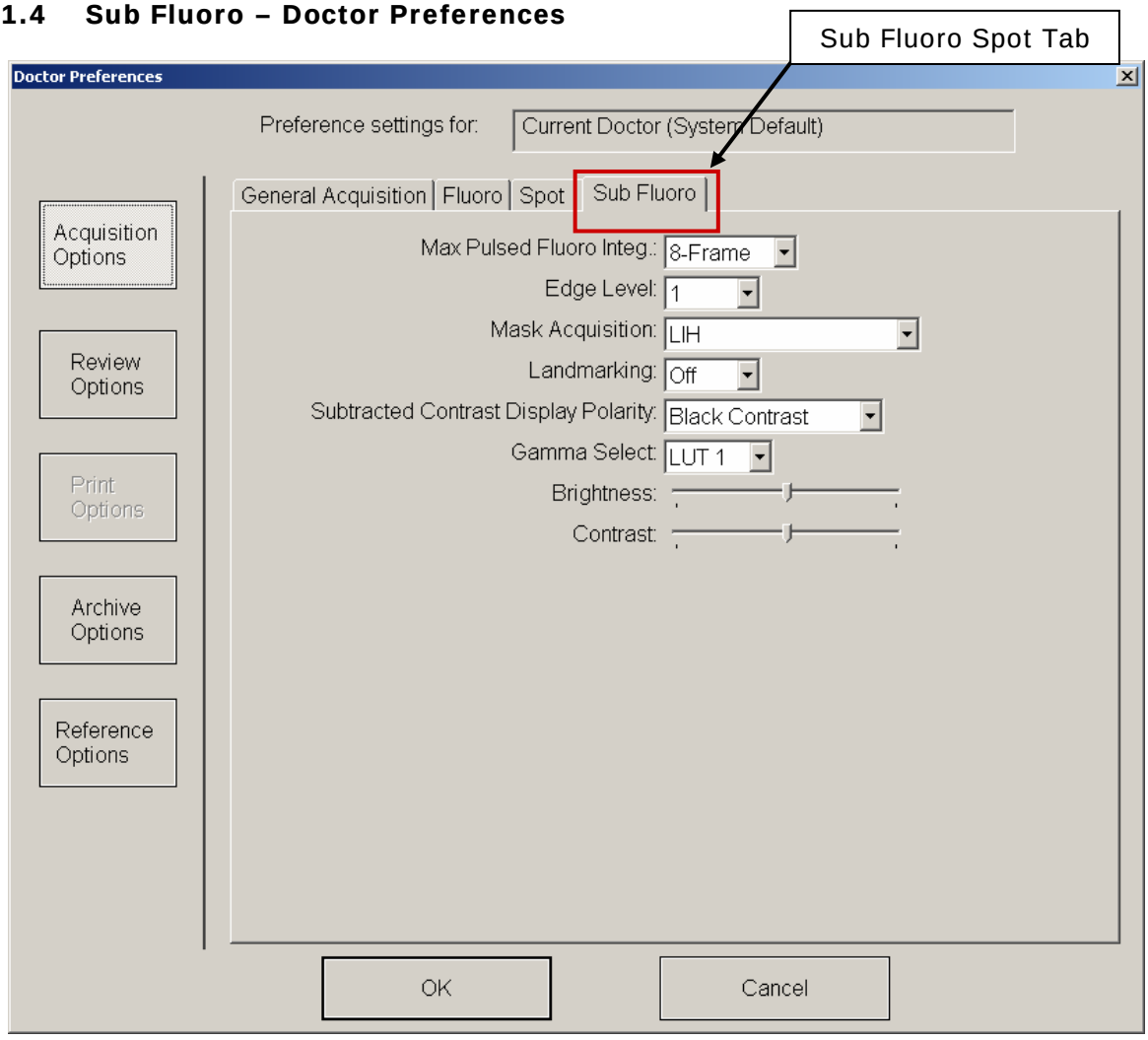
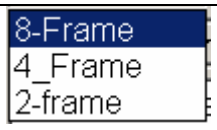
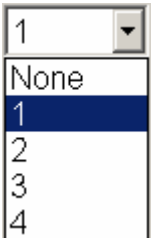
4.3.1.4 Sub Fluoro – Doctor Preferences



Sub Fluoro	**Max Pulsed Fluoro Integration Level:** Click ▼ to select Maximum allowed integration level from drop-down menu. Select 8-Frame, 4-Frame, 2-Frame or 1-Frame 
	Edge Level: Select the desired level of Edge Enhancement. The higher the level of Edge Enhancement applied, the sharper the contrast within the image There are five possible settings: None, 1, 2, 3, and 4. Higher setting equates to more filtering. Desired setting is site and viewer dependent. The Active Edge setting (by image type) will remain active for subsequent image acquisition or image review until changed. 

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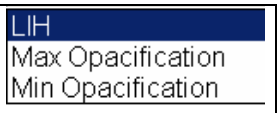
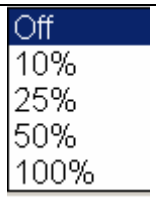
Mask Acquisition:

Click to select mask acquisition setting from drop-down menu.
Max and Min Opacification only available on DSA-systems.



Landmarking: A small amount of the mask image is added back to the subtracted image. Landmarking is usually performed to assist the doctor in preparation of invasive procedures.

Click to select the desired percentage (%) from drop-down menu.



Subtracted Contrast Display Polarity:
The *Subtracted Contrast Display Polarity* button changes the *Polarity* of an image from a black *Contrast* image into a white *Contrast* image or vice versa.

Black Contrast: Black background display for current image.

White Contrast: White background display for current image.

Gamma select:

This feature allows for more advanced Customization of LUTs by offering five different Programmable LUT selections.

Normally, the Default LUTs are adequate and this tool is not normally needed in most Clinical Applications.

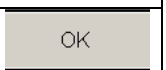
To use this feature, click for Drop-down menu to desired Gamma Level: **LUT 1, LUT 2, LUT 3, LUT 4 and LUT 5.**

Brightness:
Use slider control to select the default Sub Fluoro Brightness value.

This function can only be changed within the Service Application.

Contrast:
Use slider control to select the default Sub Fluoro Contrast value.

This function can only be changed within the Service Application.

To save settings and exit Doctor Preferences…	Click OK at the bottom of the screen	
To cancel settings and reset default…	Click Cancel at the bottom of the screen	

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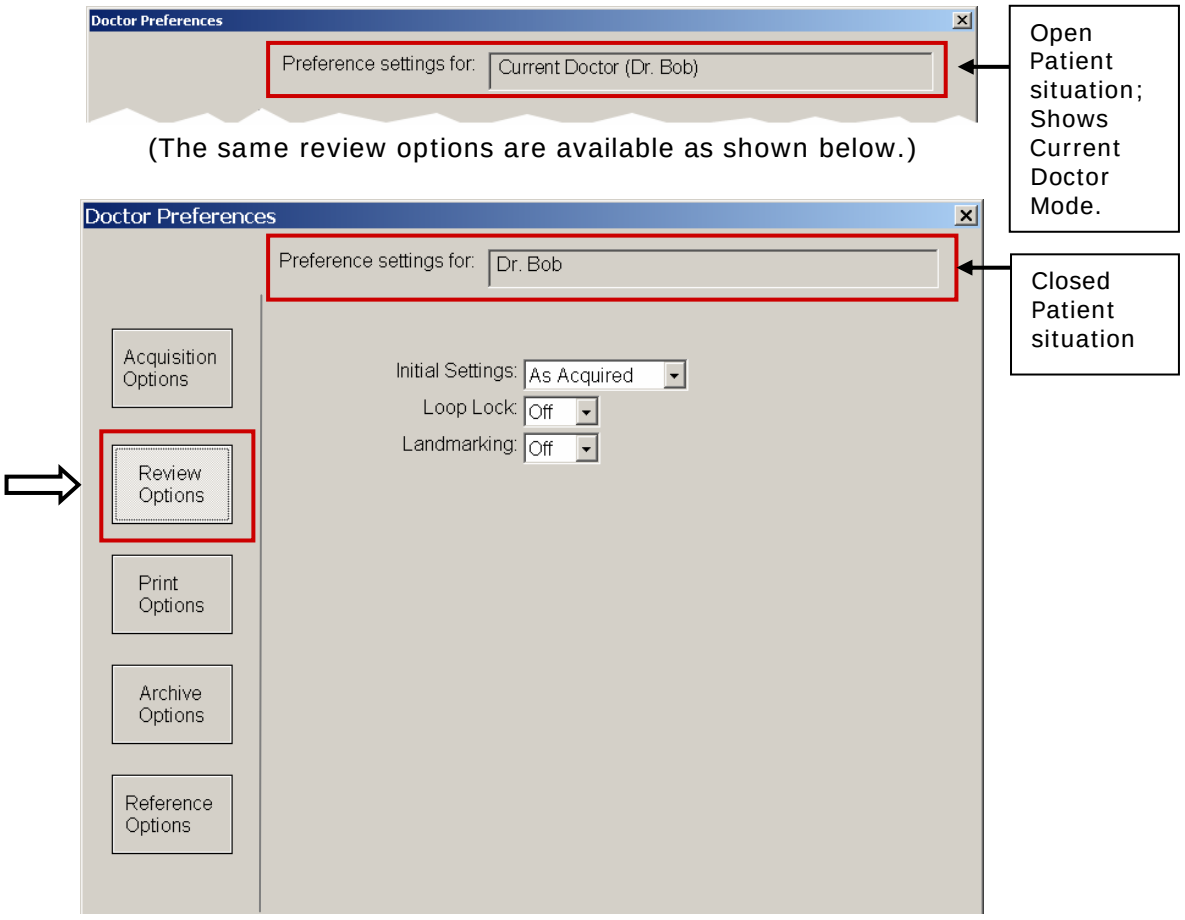
4.3.2 Review Options – Doctor Preferences



Review Options	**Initial Settings:** Determine how image will be presented during the review process either with settings made during acquisition or when last reviewed.	As Acquired Last Viewed
	Loop Lock: Lock replay within a sequence or with a study. Turn on or off by selecting from drop down menu.	Off On
	Landmarking: A small amount of the mask image is added back to the subtracted image. Landmarking is usually performed to assist the radiologist in preparation of invasive procedures. Click ▼ to select percentage (%) from drop-down menu.	Off 10% 25% 50% 100%
To save settings and exit Doctor Preferences…	Click OK at the bottom of the screen	OK
To cancel settings and reset default…	Click Cancel at the bottom of the screen	Cancel

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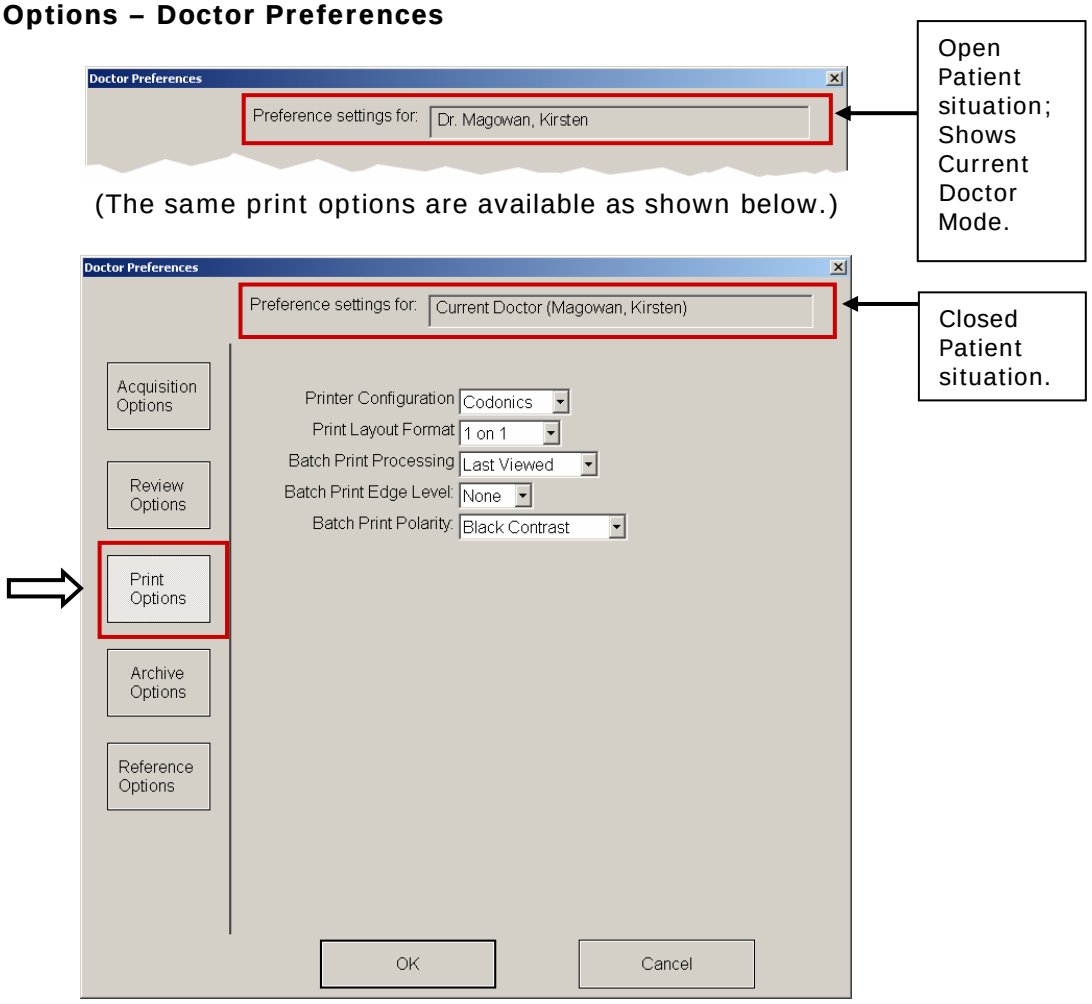
4.3.3 Print Options – Doctor Preferences



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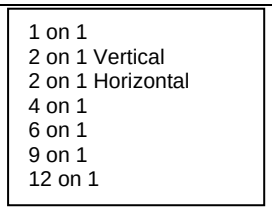
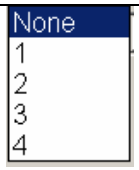
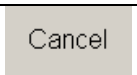
Print Options	**Printer Configuration:** Select default printer from a list of installed printers.	
	Print Layout Format: Select number of images to be printed per sheet of film.	
	Batch Print Processing Settings: Select how images are to be printed – as they were viewed or with PACE parameters applied.	
	Batch Print Edge Level: Select amount of Spatial Edge Enhancement to be used for conducting PACE printing operation if PACE is selected. The higher the level of Edge Enhancement applied, the sharper the contrast within the image.	
	Batch Print Polarity: Select the Polarity to be used for PACE printing.	
To save settings and exit Doctor Preferences…	Click OK at the bottom of the screen	
To cancel settings and reset default…	Click Cancel at the bottom of the screen	

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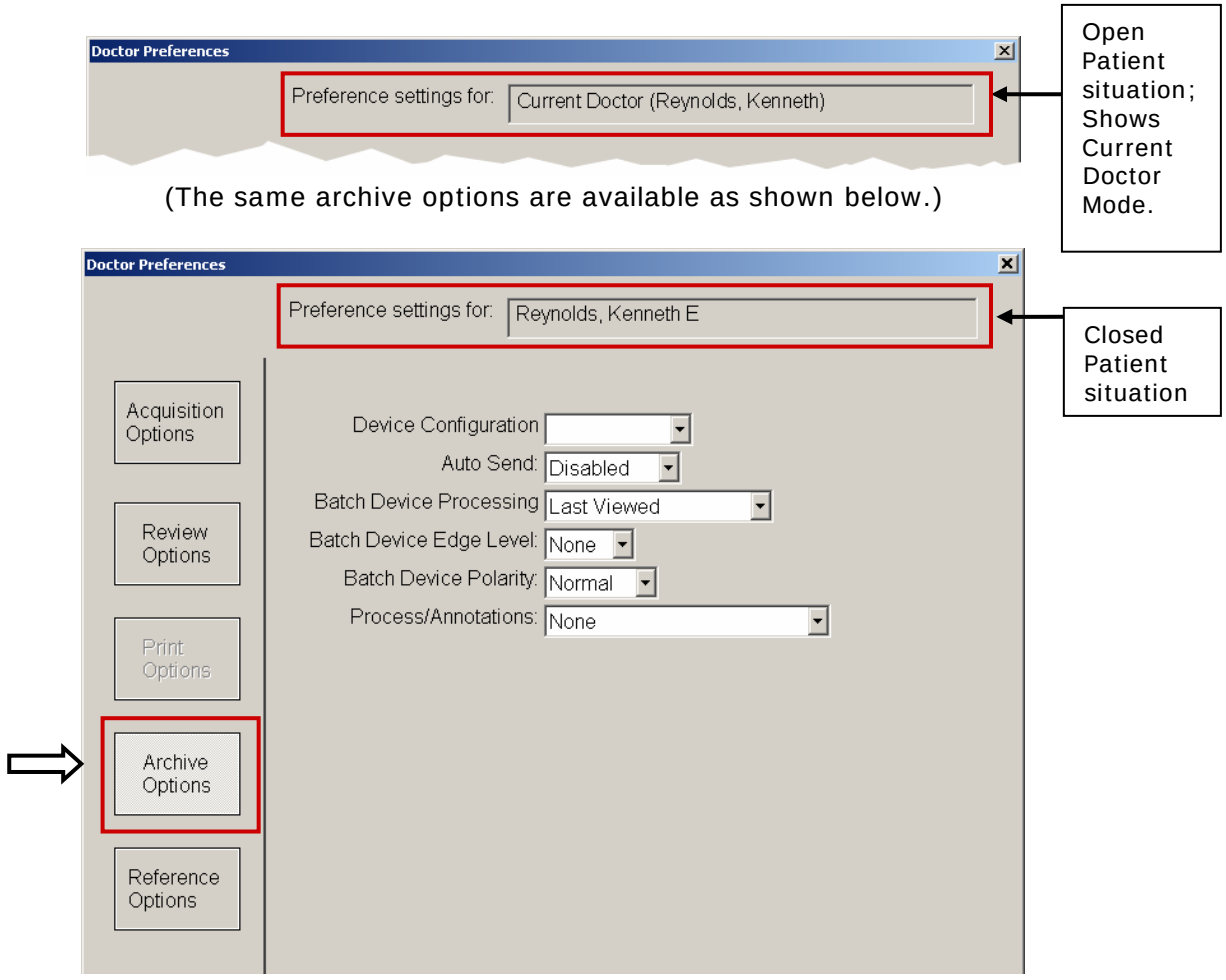
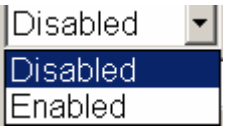
4.3.4 Archive Options – Doctor Preferences



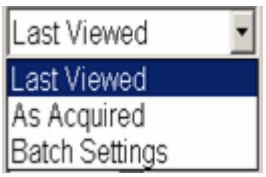
Archive Options

Device Configuration:
Select which device will be used as the default Archive device.

Auto Send:
When this feature is Enabled the system will automatically send the new acquired images to the selected Archive device.



Batch Device Processing:
This feature controls the processing settings that will be used when Archiving images (as they were Last Viewed, as they were originally acquired or with Batch Settings set at this screen).



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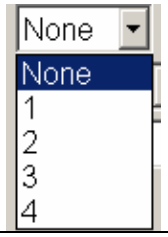
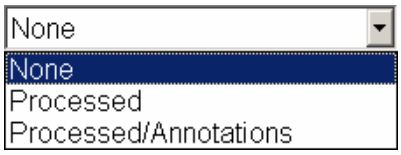
	Batch Device Edge Level: Select the level of Edge Enhancement to be used for the Archive functions. The higher the level of Edge Enhancement applied, the sharper the contrast within the image	
	Batch Device Polarity: Select the Polarity to be used when archiving images.	
	Process Annotations: Allows selection of options to be applied to images to be archived. **None** No features will be applied **Processed** Image processing features will be applied **Processed Annotations** Both image processing features and Annotations will be applied	
To save settings and exit Doctor Preferences…	Click OK at the bottom of the screen	
To cancel settings and reset default…	Click Cancel at the bottom of the screen	

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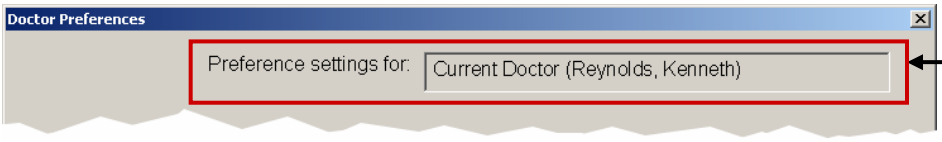
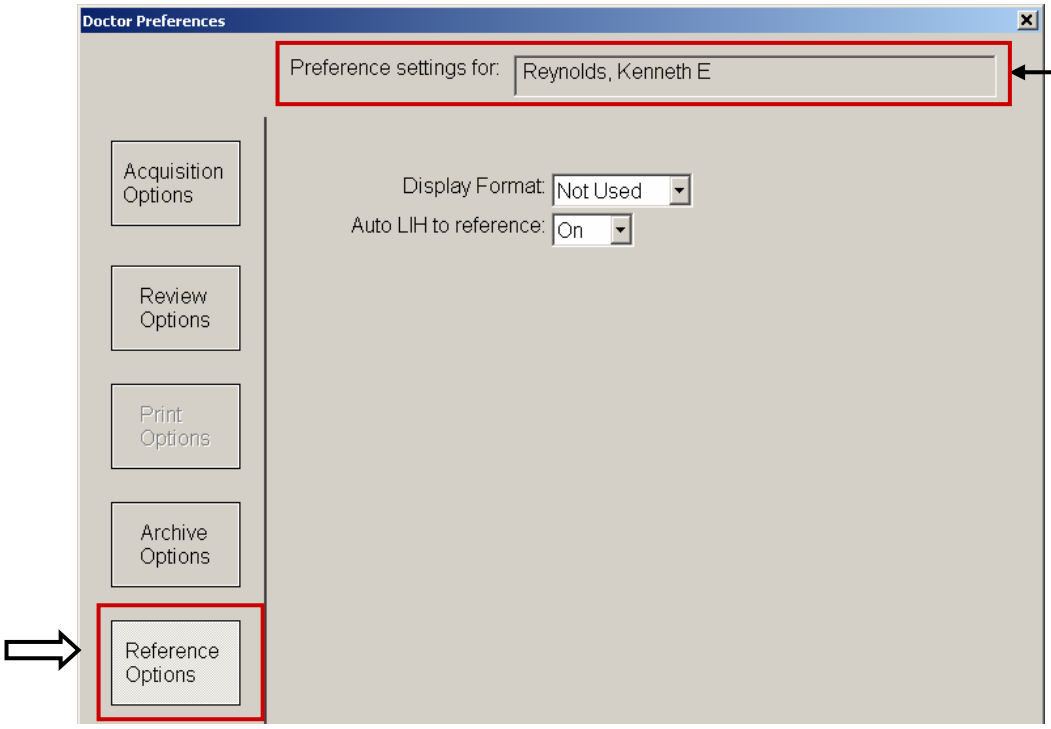
4.3.5 Reference Options – Doctor Preferences



Open Patient situation; Shows Current Doctor Mode.

(The same reference options are available as shown below.)



Closed Patient situation

Reference Options	**Display Format:** This preference is only available when the Multi-format Reference Image Display option is installed.
	Auto LIH to Reference: The Auto LIH to Reference feature automatically transfers each LIH image to the Reference Display when the next acquisition begins. Select **ON** to activate this feature.

To save settings and exit Doctor Preferences…	Click OK at the bottom of the screen	OK
To cancel settings and reset default…	Click Cancel at the bottom of the screen	Cancel

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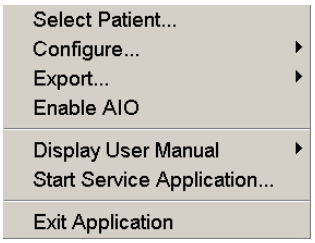
4.4 PROGRAMMABLE SEQUENCES (DSA ONLY)

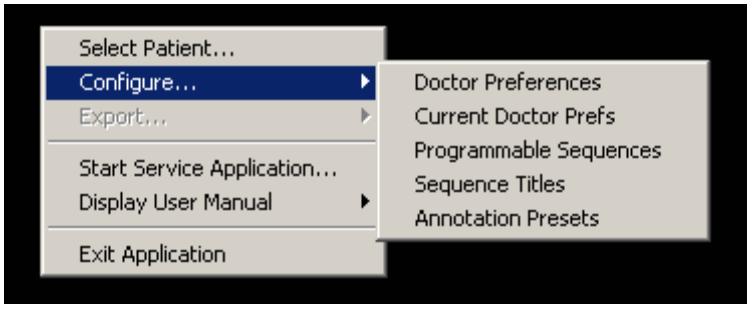
Selecting a Programmable Sequence for image acquisition will automatically control the acquisition rate and the time (in seconds) at which images are acquired.

4.4.1 Create New Programmable Sequence

1. Right-click while cursor is over the image display area. The **right-click menu** will display.



2. Position cursor on Configure... button and a second sub-menu will display.



3. Left-Click on Programmable Sequences

4. The *Programmable Sequences* screen will display.

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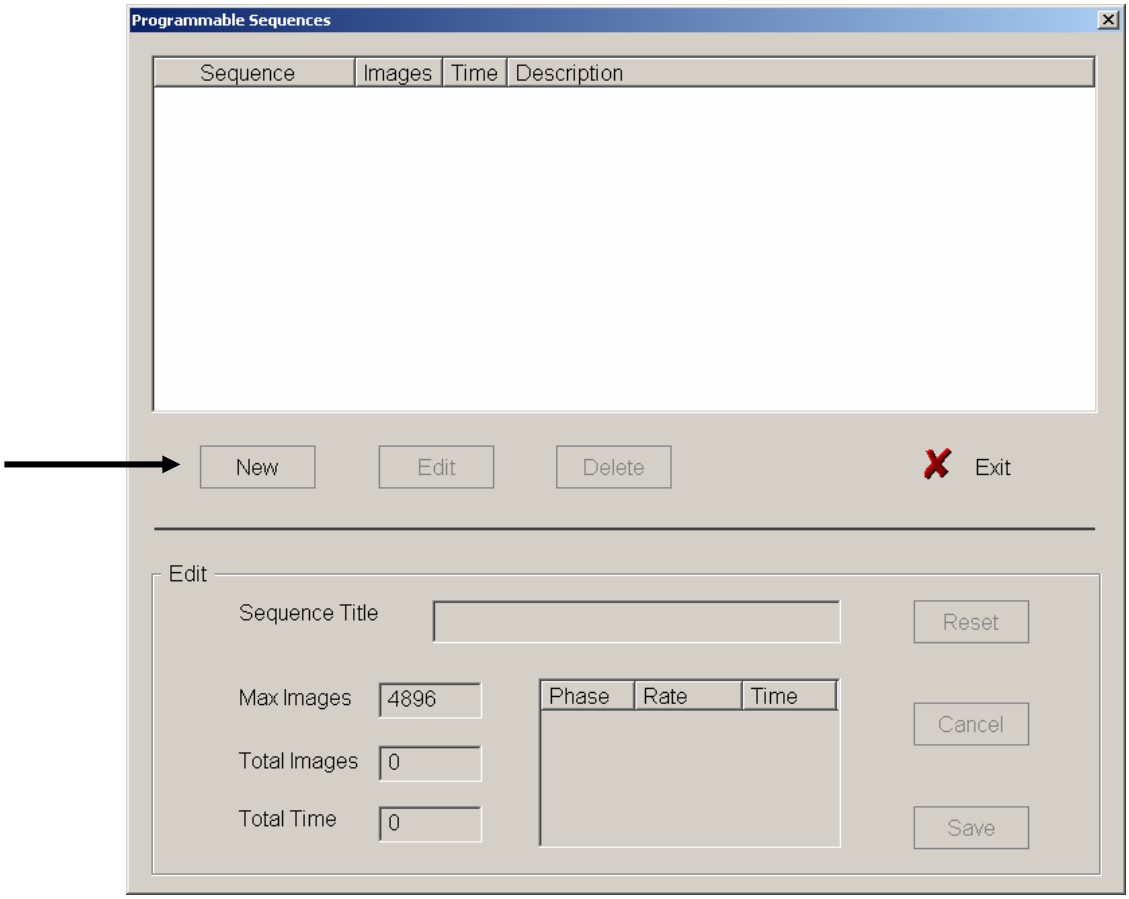
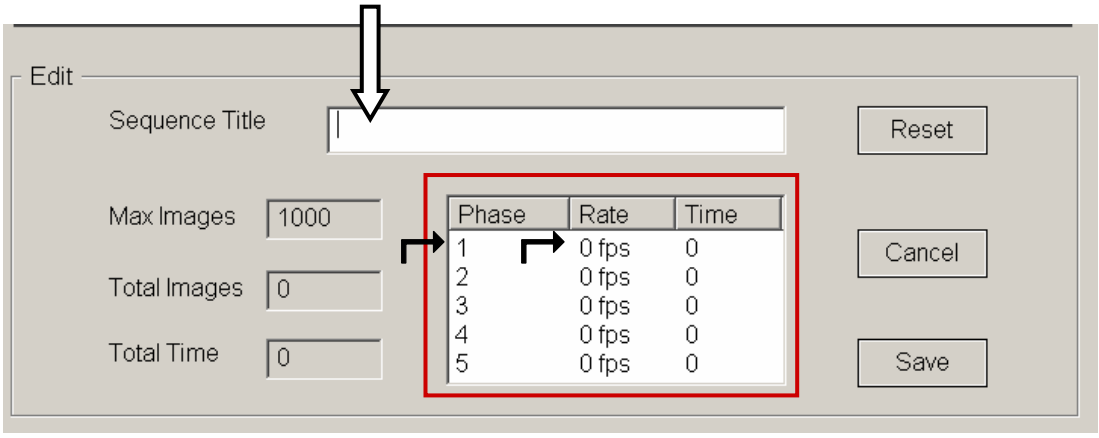
5. Left-Click on the New button



6. Enter the "Sequence Title" in text box.



7. Click on the Phase to be edited.

8. In the same row, double-click on "0 fps" in Rate column.

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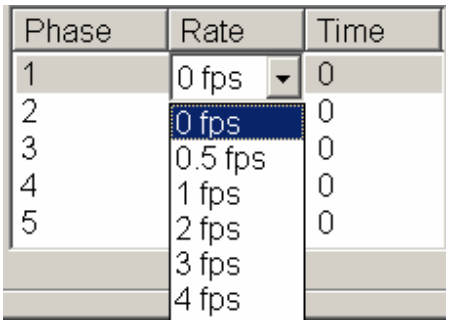
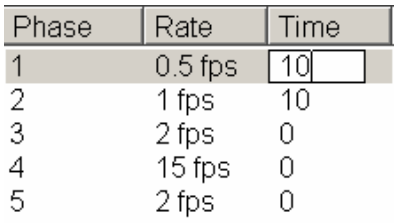
9. The fps (frames per second) drop-down menu will display. Click on the desired acquisition rate.



10. Click on the 0 in the Time column – in line with the Phase selected.

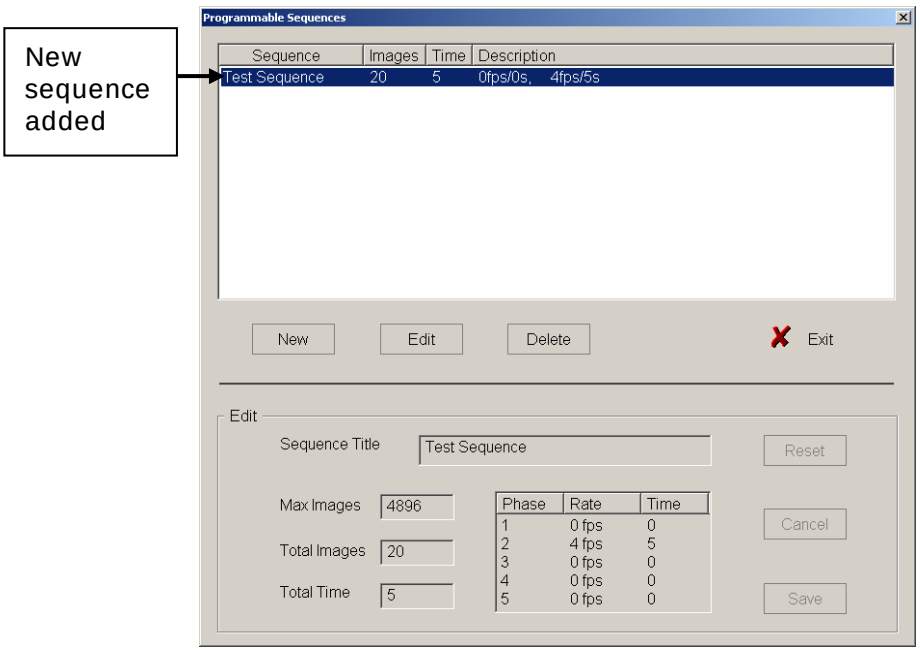
11. Enter the number of seconds to acquire at the specified rate.



12. Repeat steps 4-11 to configure as many phases as needed.

13. Click on the Save button to save the sequence settings. Optionally, click on the Cancel button at any time to clear the current settings.

14. After the save button is clicked, the *Programmable Sequences* window will display with the new sequence added to the list.



Programmable Sequence Selection Screen

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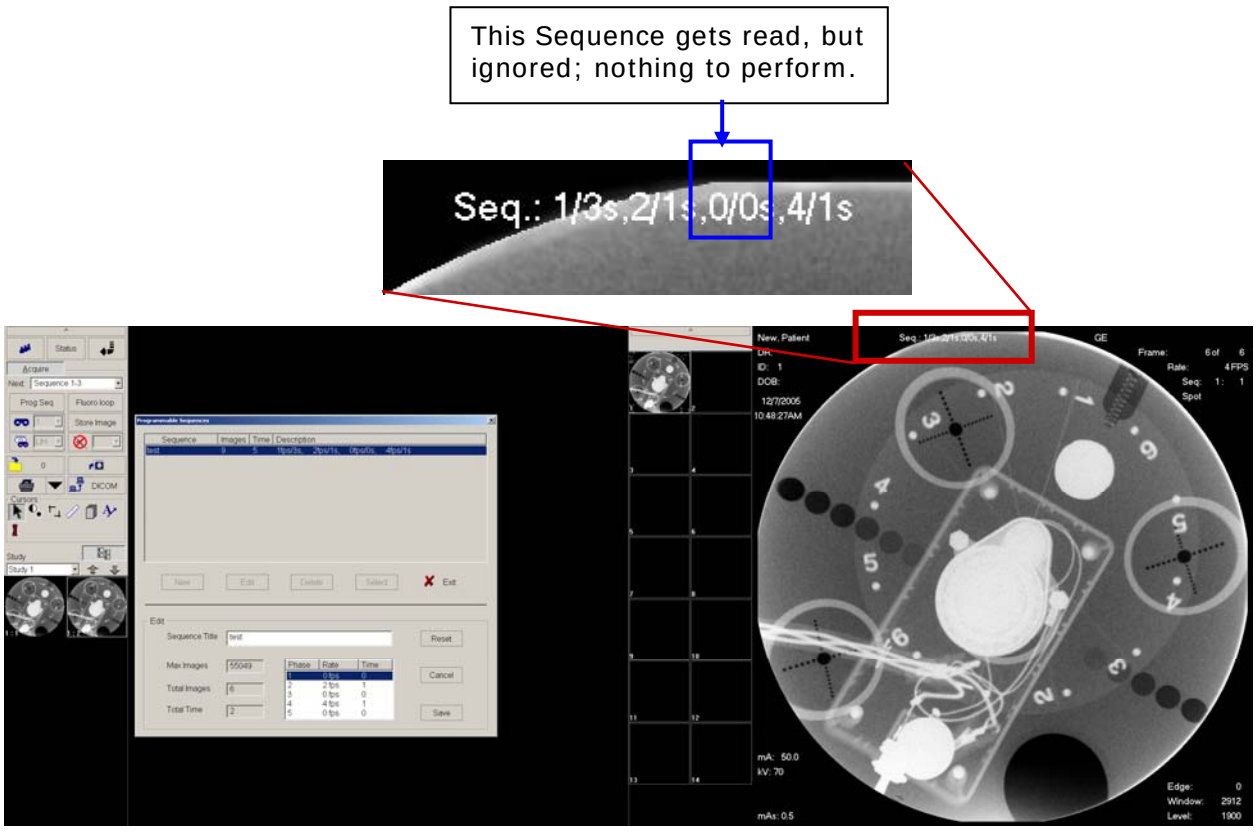
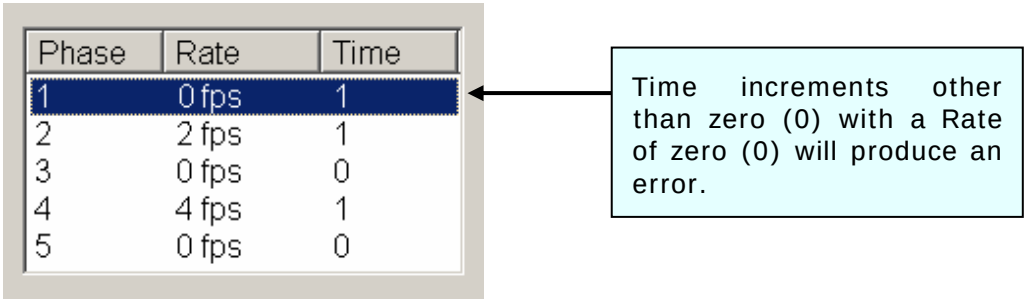
Rates of 0 fps with Time of 0 are essentially skipped when running the Sequence. A screen notation of the Sequences run will display at the top center of the Display Area. This notation shows that only Sequences 1, 2 and 4 were executed.



Main GUI Sequence Viewing Monitor

Rates of 0 fps in any Phase will require a Time of 0. If an increment other than zero (0) is placed in the Time Column, a Warning message Pop-up will display over the Programmable Sequences screen.


Phase Rate Time
1 0 fps 1
2 2 fps 1
3 0 fps 0
4 4 fps 1
5 0 fps 0
Time increments other than zero (0) with a Rate of zero (0) will produce an error.

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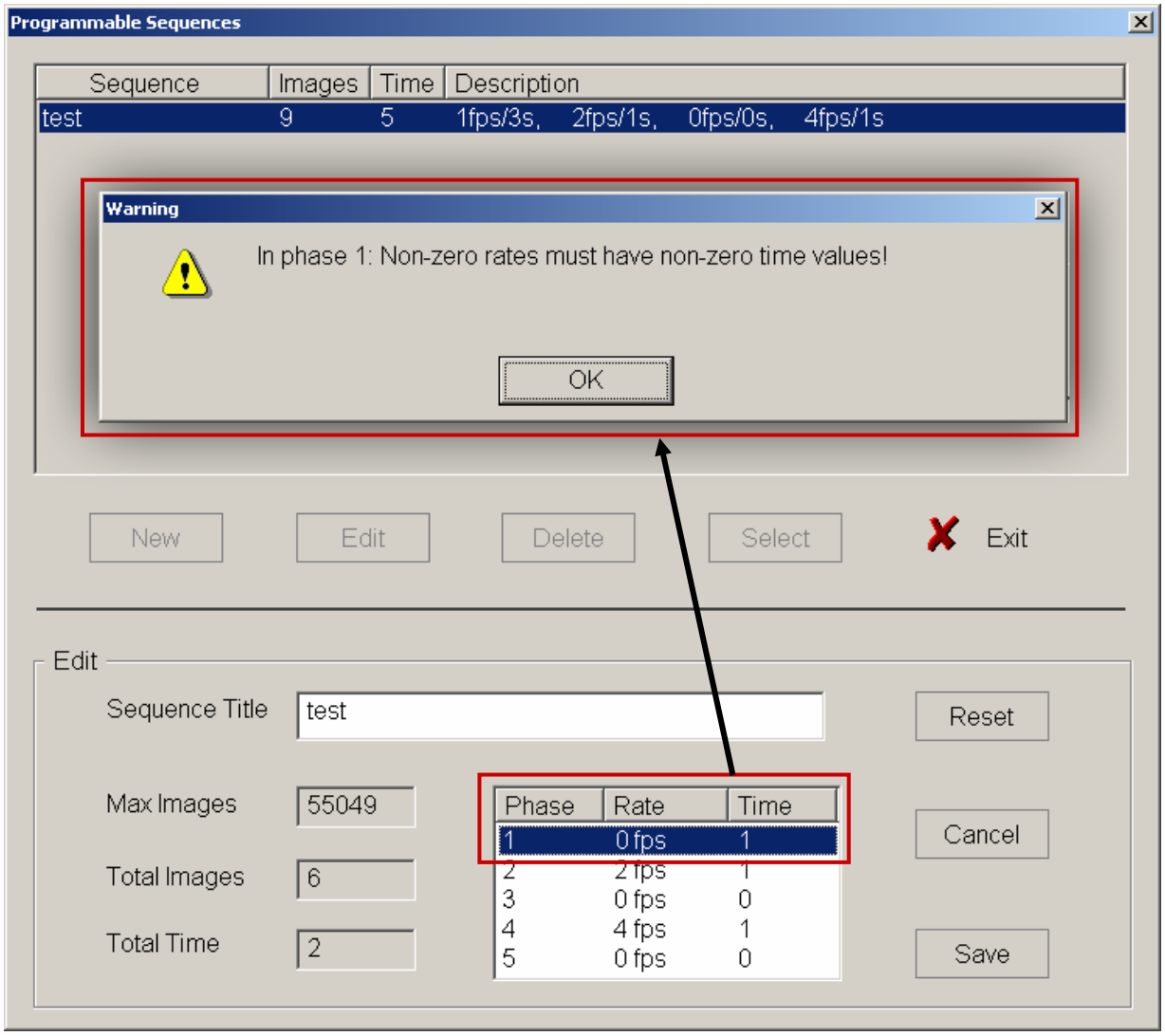

Programmable Sequences Screen with a Pop-up Warning Message Displayed

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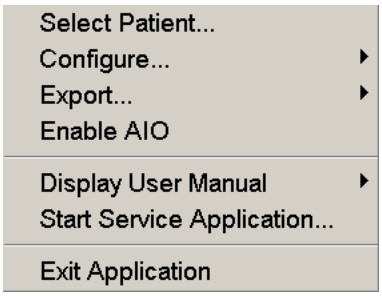
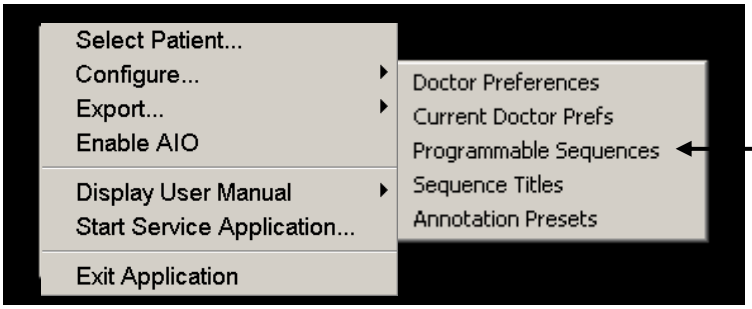
4.4.2 Edit Existing Programmable Sequence

1. Right-click with cursor over the image display area. The **right-click menu** will display.



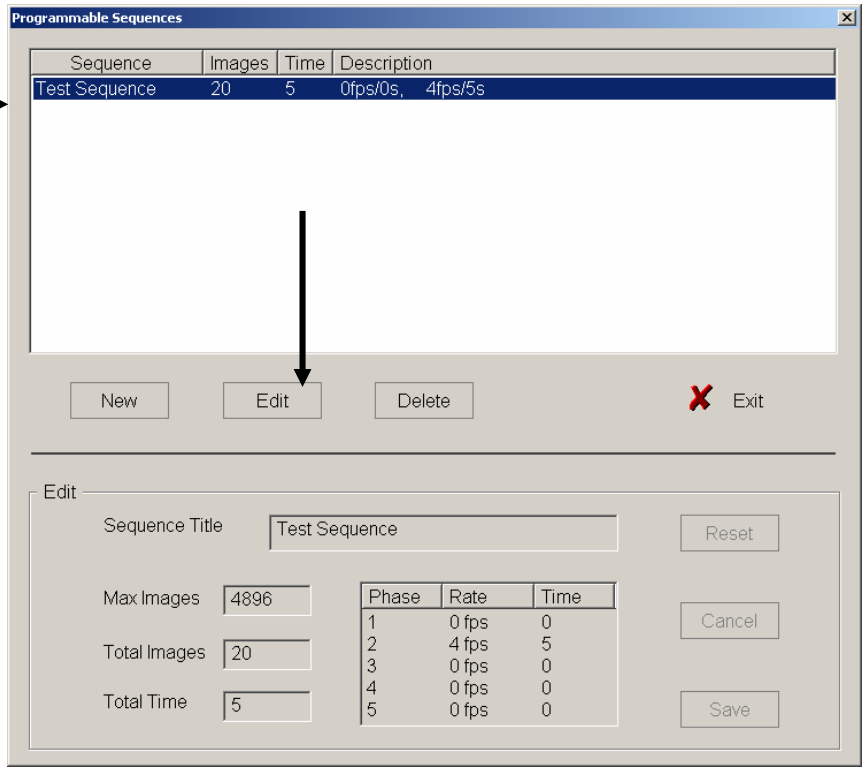
2. Position the cursor Configure... and a second sub-menu will display.



3. Left-Click on Programmable Sequences

The ***Programmable Sequence*** screen will display.

Current settings for highlighted sequence.



4. Left-click on the sequence to be edited.

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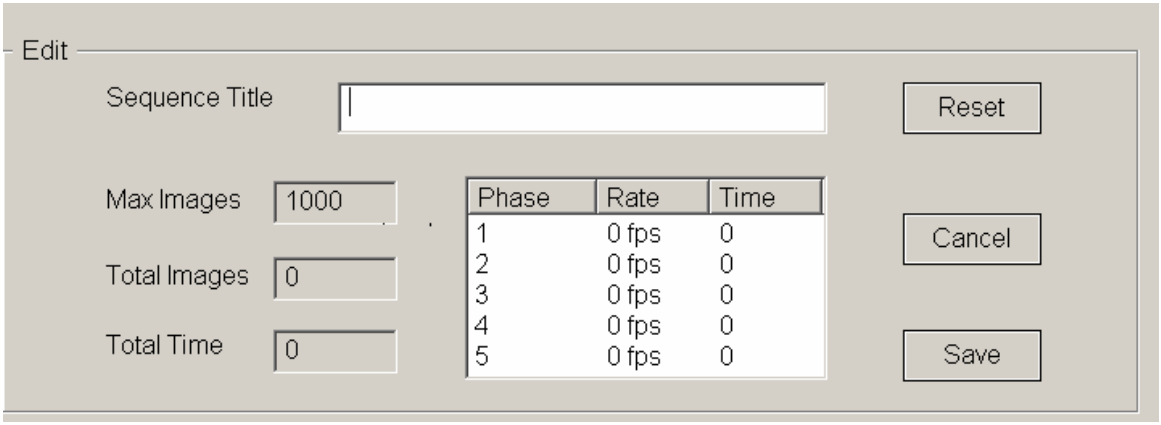
5. Left-click on the **Edit** button. The ***Edit Programmable Sequence*** window is enabled.

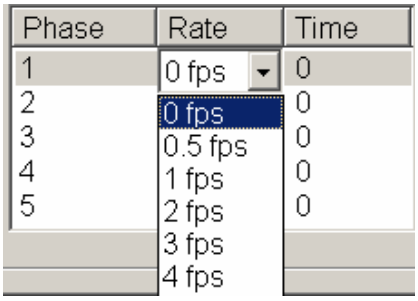
NOTE: The sequence can be deleted by highlighting and clicking Delete



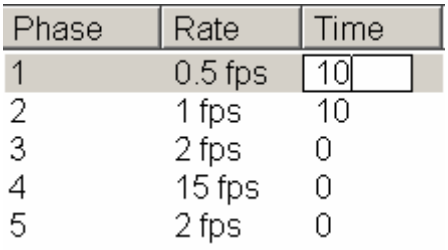
Edit Programmable Sequence Screen

6. Edit the **Sequence Title** if necessary.

7. Double left click on the **Rate** drop-down list to change the acquisition rate for any phase.



8. Enter the number of seconds to acquire in the Time box.



NOTE: Click on the Reset button at any time to clear all the settings

9. Click on the **Save** button to save the sequence settings.

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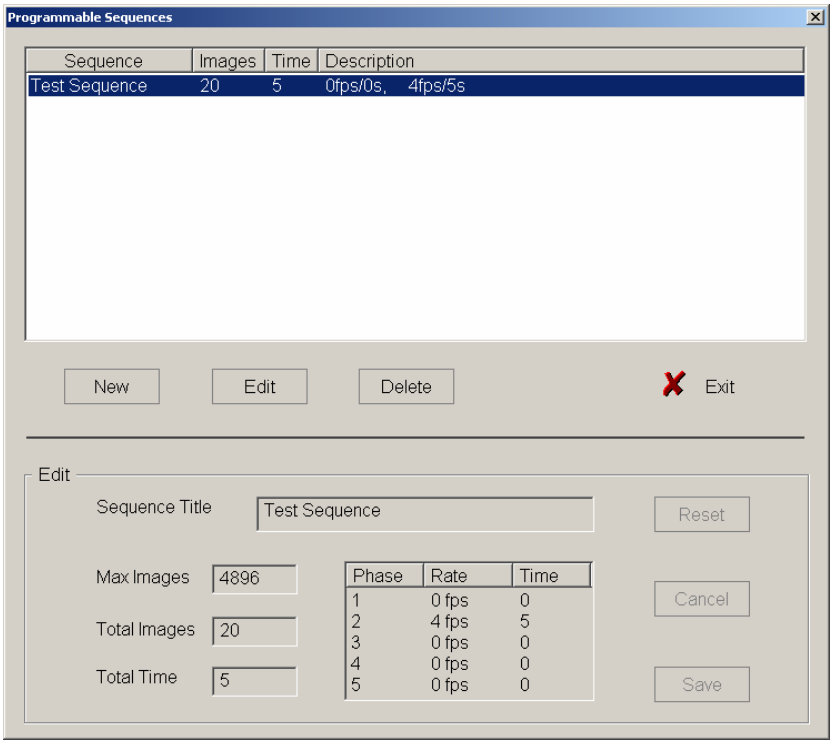
10. The ***Edit Programmable Sequence*** menu is disabled, and the ***Programmable Sequences*** window is updated with the new sequence added to the list.



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WARNING: Do not start up the GE Precision MPi system until all operators present have read and fully understood the safety information and emergency procedures described in Chapter 2 of this Operator's Manual.
Operation of GE Precision MPi without having read and understood all safety information and procedures in the Safety Chapter could lead to fatal or other serious personal injury.

5.1 SYSTEM DESCRIPTION

GE Precision MPi is a multipurpose digital fluoroscopic and imaging workstation ideal for a wide range of routine and special examinations requiring special patient positioning and compound x-ray beam projections.
GE Precision MPi consists of a floor-mounted stand with a tiltable patient table. The C-arc, mounted to the stand, support both Image Intensifier and X-ray tube/collimator. The C-arc can be moved along and around the patient table.

Main components of the GE Precision MPi:

1. Base unit
2. Main arm
3. C-arc carriage
4. C-arc
5. Patient table support
6. Patient table
7. Collimator touchguard
8. Image Intensifier
9. Image intensifier touchguard and grid
10. X-ray tube and collimator
11. Cable guide
12. Sidearm, vertical
13. Mobile control panel
14. Positioner information monitor

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Digital imaging system components

Monitor
- Used for viewing the menu screens and images. Used for Control Room and In-Room (Primary and Reference)
- Standard Flat Panel Monitor

PC Cabinet
- Image Acquisition Processing Display Board (IAPDB)
- Hard Drive
- 3.5" Floppy Drive
- Internal PCI modem
- CD-R/CD-RW Drive

Keyboard
Standard 104 key w/PS2 connector.

Pointing Device
Wheel Mouse

5.2 SYSTEM OPERATION

The movements of GE Precision MPi are controlled from a mobile control panel on a pedestal close to the positioner or from a second identical control panel often placed near the generator touch screen for remote operations.

Equipped with a computer controlled safety system with respect to ceiling and floor and a touchguard on the image intensifier for collision detection, GE Precision MPi ensures patient safety and equipment protection.

Both analogue and digital position indicators are provided, digital displays on the top of the base unit indicate the angulation of the C-arc and tilting of the table assembly and an analogue indication of the C-arc rotation is given by scale markings on the inside of the C-arc.

A monitor will show positions of the following movements: CAT, CAR, MCU, MAT, TUD, TTT and IIE with large easy-read numbers. IIE will be indirectly shown as source-image distance (SID).

REF.	MOVEMENT
MAT	Main Arm Tilt
MCU	Main Center Up/down
MAC	Main Arm Carriage (scan)
CAT	C-Arc Tilt
CAR	C-Arc Rotation
TUD	Patient table Up/down
TIO	Patient table In/out
TTT	Patient table Tilt
IIE	II Elevator

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The stand is mounted with an insulation set for electrical insulation of the positioner from the building or other structures during angiography.

The digital imaging system can be used to acquire radiographic and fluoroscopic images in real-time with RF and DSA processing features and functions.

Patient images can be viewed at any time, in a variety of ways and can be enhanced to your preference. Computerised image processing features such as the adjustment of contrast, overall brightness, increased detailed views and magnification allow for the display of diagnostic details which may be difficult or impossible to see using conventional techniques.

The digital imaging system offers several image and data transfer options that provide ample flexibility for patient data handling. These features allow both images and patient data to be sent and received between the system and a DICOM 3.0 compatible network device or a CD-RW. The archival of images prevents loss as well as keeps the system from becoming full. Additionally, networking allows images to be retrieved from any station on the network.

5.3 CONFIGURATION AND OPTIONS

The positioner can operate with the image intensifier either above or under the patient table (AP/PA). It is recommended to perform as many examinations as possible with the image intensifier above the table since this poses the smallest possible dose to both patient and operator.
The positioner allows for multiple projection angles with minimum patient repositioning:

- Tilt option of +90° to -90° for Trendelenburg
- C-Arc rotation of-45° (RAO) to +90° (LAO)
- C-Arc angulation of+45° (cranial) to -45° (caudal)
- Patient access height of only 55 cm (21.7 in)
- Variable focus to Image Intensifier distance of 102-125 cm (40.2 – 49.2 in)
- Patient table angulation of +20° to -20°
- C-Arc Scan along the patient table of 150 cm (59.1 in)
- Two identical control panels for all motorized controls

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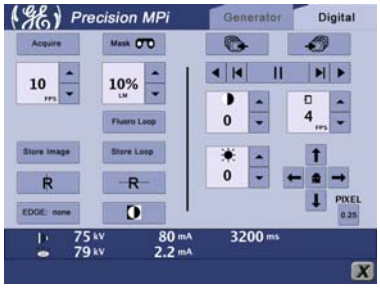
5.4 CONTROLS, INDICATORS AND BUTTONS

This section describes all keys, buttons and indicators on the entire system. The description includes all items mentioned as optional. Therefore not every function described in this section may be available on your system.

1. Generator touch screen
2. Remote Touch Panel
3. Control panels
4. Digital Imaging System Keyboard and Pointing device
5. Digital Imaging System Monitor
6. Digital Imaging System Cabinet
7. Positioner information monitor
8. Foot switch / hand switch
9. Positioner emergency control
10. Positioner ON/OFF

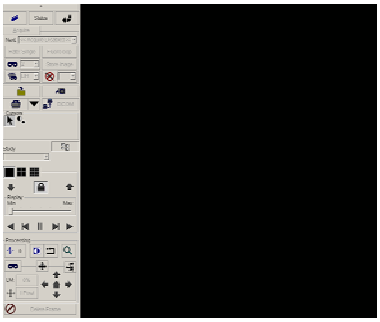
1



2

3

4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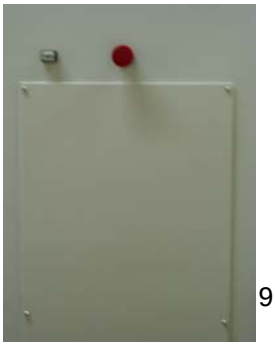
9

10

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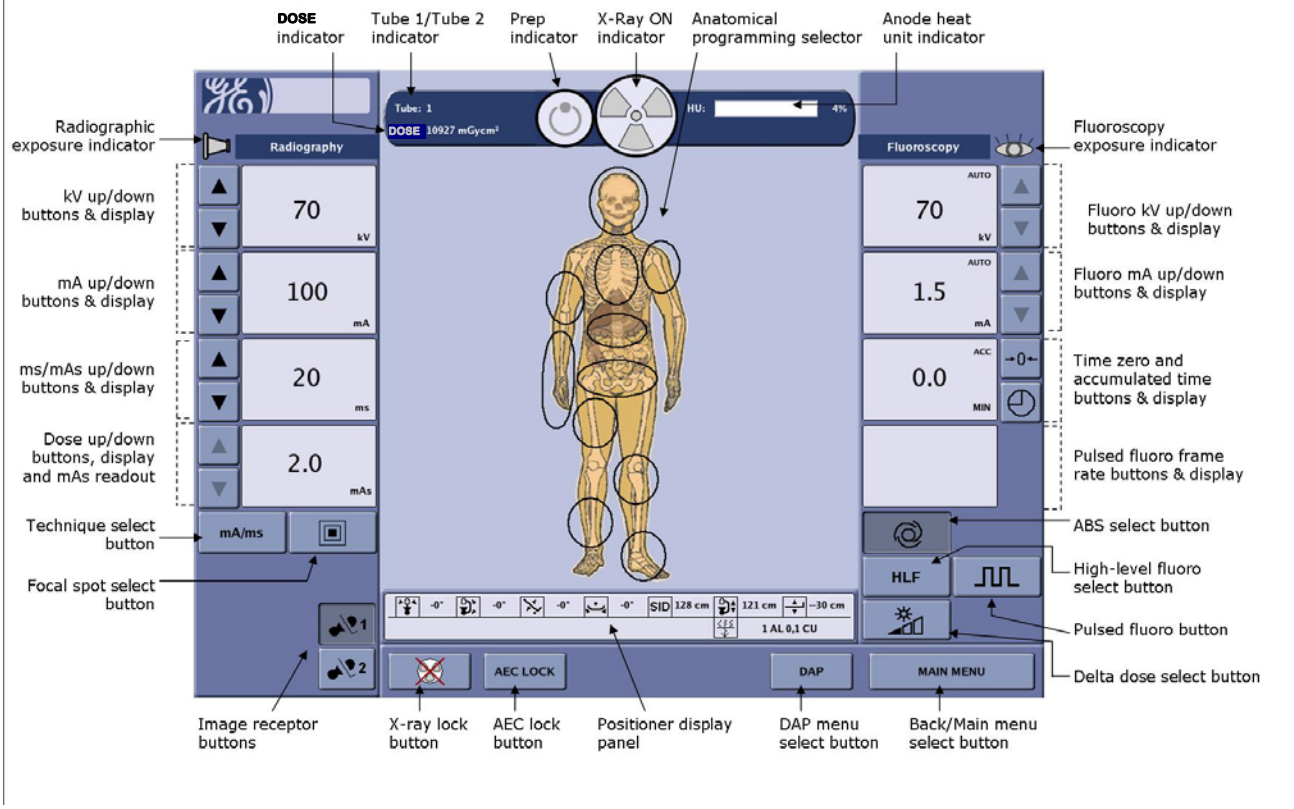
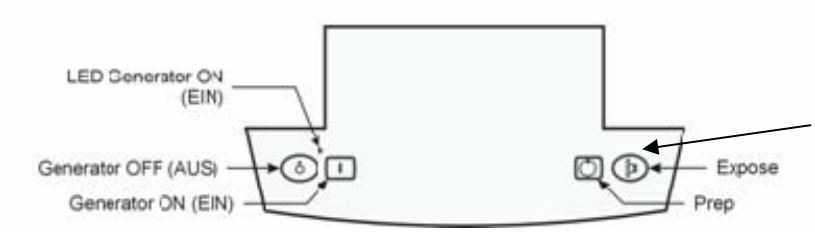
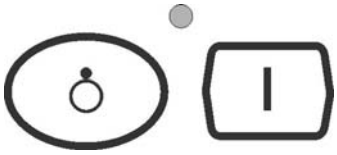
5.4.1 GENERATOR TOUCH SCREEN





NOTE: The above console display is typical. The display on your system may vary depending on programming and technique selections. Minor variations may exist in font size or style, color scheme and graphic styles to suit specific customer requirements.

5.4.1.1 General functions



Press I to switch the X-ray generator on. The LED adjacent to the generator on / off switches will light when the generator is switched on.

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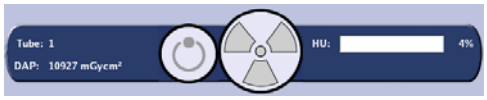
These buttons: prep and exposure are disabled in the standard configuration.
Use Foot Switch or Hand Switch instead.



When the prep state is active, the prep indicator on the touch screen display will change to green.
When the prep cycle is complete, **Generator Ready** will be displayed.

During a radiographic X-ray exposure, the and symbols will change to yellow. This will be accompanied by a continuous tone from the console.

During a fluoroscopic X-ray exposure, the and symbols will change to yellow. This will be accompanied by an intermittent tone from the console.

Heat Units (HU)

The percentage of the X-ray tubes' Heat Unit capacity used is shown in this display. A Warning-level and a Limit-level are programmed and will appear on the touchscreen when reached.

Image receptor buttons

Show the selected. This is done automatically according to pre-defined dose settings. Buttons cannot be selected.

The figure at the left is intended to show the image receptor button layout only. The receptor symbols are typically customized for each installation. This may be done at the time of installation, or after installation as required.

X-ray lock

Activating this button blocks the possibility of unintended irradiation. When the button is active 'X-Ray Lock Out Active' will be shown on the screen.

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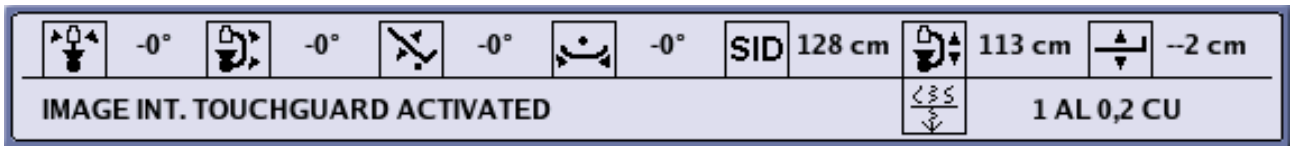
Dose functions

Press and a menu of Reset and Print opens.
Choose Reset to reset cumulative dose when the dose has been saved with the patient file.

WARNING: Do not press the reset button before the examination has completed.

Choose Print (if a dose printer is installed) to print the cumulative dose value.

Guidance information



Upper line shows the positions of 7 different positioner movements. The positions are identical to the ones shown on the positioner information monitor.
Lower line to the left shows any guidance information from the positioner e.g. in case of collision with floor or ceiling.
Lower line to the right shows the spectral filters chosen. Toggle between the 3 different filters and 1 void on either of the control panels as described in Chapter 5.4.2 Control panels.

BACK / Main Menu

Use this button to

- return to previous level in APR-menu
- Exit examination mode. This should be done after each patient in order to avoid unintended irradiation.

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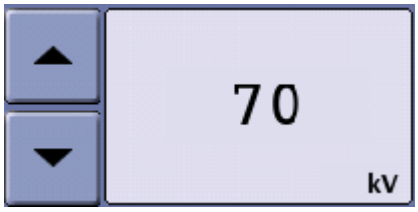
5.4.1.2 Radiography

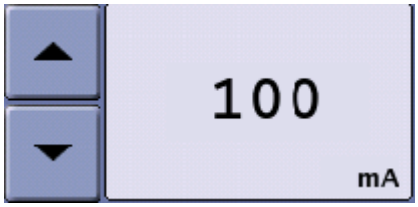


kV up / down buttons and display

To increase kV, press ▲
(Radiography max. 140 kV)
(Fluoroscopy max. 125 kV)

To decrease kV, press ▼
(Radiography min. 40 kV)
(Fluoroscopy min. 40 kV)

Displays demanded kV of the exposure.



mA up / down buttons and display

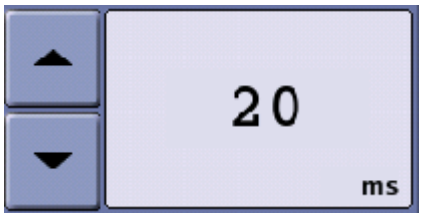
To increase mA, press ▲.

To decrease mA, press ▼.

The mA may be adjusted when AEC or mA/ms is selected.

The pre-selected mA is displayed in smaller font when mAs is selected. The mA is not adjustable in mAs mode.

Radiography 10 to 1000 mA (100 kW),
Conventional Fluoroscopy 0.5 to 6.0 mA
High Level Fluoroscopy 5.0 to 20 mA
Pulsed Fluoro 10 mA to 20 mA



ms / mAs up / down buttons and display

To increase ms or mAs, press ▲ (max. 6300 ms)

To decrease ms or mAs, press ▼ (min. 1.0 ms)

Displays ms when mA/ms is selected.

Displays mAs when mAs is selected.

Displays AEC or shows the AEC backup ms or mAs in AEC mode. Review the note below regarding AEC backup options.

Displays post-mAs after an AEC exposure.

The AEC backup mode is installer programmable for each receptor. If **FIXED** AEC backup time has been programmed for the selected receptor, the backup ms and mAs cannot be adjusted. If **ms** or **mAs** AEC backup has been selected, the AEC backup ms or mAs respectively is operator adjustable within preset limits by pressing the **+** or **-** buttons.

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Dose selection and display and mAs readout

To increase dose, press ▲

To decrease density, press ▼

Three doses are selectable: A, B and C

Displays dose when AEC is selected.

Each dose step will double the dose.

In mA/ms mode, displays the calculated mAs of the next exposure in smaller font (based on the selected mA and ms).

Technique select button

This function may be disabled in programming.

Press the technique select button until the desired technique is selected.

- **AEC** for Automatic Exposure Control (1 point technique).
- **mAs** for mAs technique (2 point technique).
- **mA / ms** for mA and ms technique (3 point technique).

Focal spot select button.

Press the focus select button until the desired focal spot is selected.

- ■ for small focus.
- ■ for large focus.

This function may be programmed for auto focal spot selection.

AEC Lock

This button disables the phototimer after a programmable number of exposures and locks the exposure time to the time of the last AEC exposure for the remainder of the exposure sequence. The purpose of the AEC Lock is to obtain proper exposure time for a study using AEC and then lock in this exposure time when contrast is injected.

AEC Lock can only be chosen on a series of exposures. Restarting the exposure run will restart the AEC Lock process.

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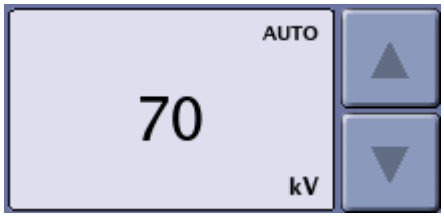
5.4.1.3 Fluoroscopy



Fluoro kV up / down buttons and display

To increase kV, press ▲ (max. 125)

To decrease kV, push ▼ (min. 4.0)

AUTO indicates that ABS is selected, therefore manual kV control is not available.

Fluoro mA up / down buttons and display

To increase mA, press ▲ (max. 6.0)

To decrease mA, press ▼ (min. 0.5)

AUTO indicates that ABS is selected, therefore manual mA control is not available.

Pulsed fluoro mode uses a fixed (not operator - adjustable) mA value.

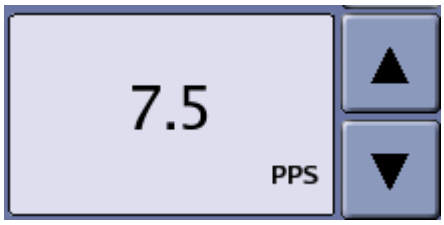
Fluoro Timer zero and accumulated time buttons and display

Displays the running and cumulative time of a fluoroscopic exposure when the accumulated time button ◴ is pressed and shaded grey.

An audible tone will sound after 5 minutes of fluoro. To reset press →0←.

To display accumulated fluoro exposure time, depress ◴.

To reset the accumulated time, press →0← when the accumulated time is displayed and the ◴ is not activated.



Pulsed fluoro frame rate buttons and display

Displays the pulsed fluoro frame rate. This is only active when pulsed fluoro is switched ON.

To increase the PPS (Pulse Per Second) rate, press ▲.

To decrease the PPS rate, press ▼.

Pulse rates are 3, 7.5, 15, and 30 PPS (Pulses Per Second).

ABS (Automatic Brightness Stabilization) select button

Press to select ABS. The fluoro kV and fluoro mA will indicate ***AUTO***.

Fluoro kV and fluoro mA may be set manually only when ABS is switched off.

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Delta dose select button

Press to select the delta dose value. The selected delta dose is shown on the delta dose select button:

low medium high dose

Pulsed fluoro select button

Press to select pulsed fluoro.

This is only active for optional pulsed fluoro.

HLF (High Level Fluoro) select button

This is only active for optional high level fluoro (HLF).

With ABS off, selects high level fluoro. The fluoro mA range is 0.5 to 6.0 mA if HLF is off, and 5.0 to 20 mA if HLF is on.

With ABS on, if “full” HLF mode is programmed, the fluoro mA range will be 0.5 to 20 mA. The generator will automatically switch between normal and HLF modes.

Manual HLF selection is not available if ABS is on.

The frequency (pitch) of the tone from the console will increase during an exposure when high level fluoro is selected.

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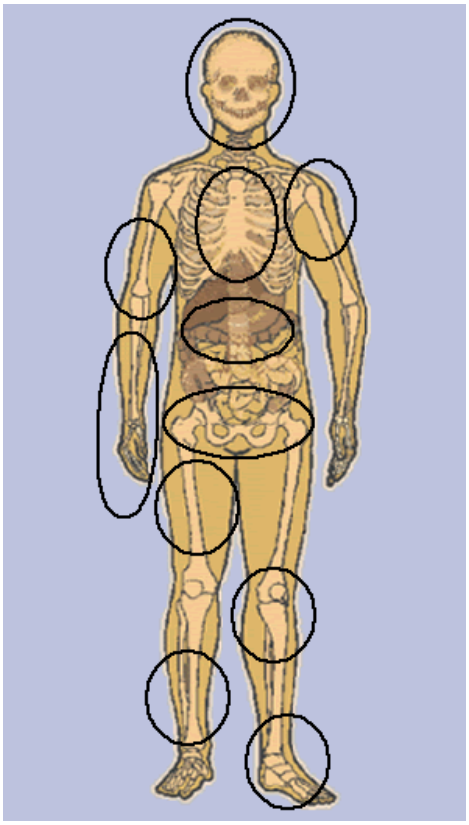
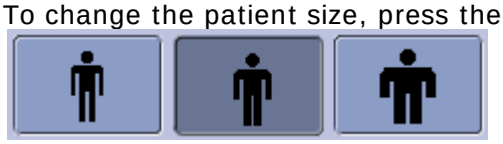
5.4.1.4 APR (Anatomical Programming)



1. Select the region of interest by pressing the appropriate area on the anatomical figure on the touch screen display (i.e. SKULL). The selected area will change to yellow and a pop-up window will appear on the display.
   - The caption on the pop-up window indicates the selected anatomical region (i.e. SKULL).
   - The pop-up window will display one or more menu, procedural, or APR items. A menu item will have an **M** beside the name, a procedural item will be identified with a **P** beside the name, and an APR item will have an **I** beside the name.
     - A ***menu item*** (i.e. SKULL) has one or more submenus. The submenu(s) may include additional menu items, procedural items, and / or APR items.
     - A ***procedural item*** (i.e. FOOT) has one submenu. That submenu will contain only APR items.
     - An ***APR item*** (i.e. FOOT AP) has no submenus. Selecting the desired APR item will set predefined radiographic or fluoroscopic protocols in preparation for an exposure.

2. If the appropriate APR item (**I** beside the item name) is shown on the selected menu, select that item. The selection will be highlighted, predefined radiographic and / or fluoroscopic parameters and techniques will be set in preparation for an exposure, and the patient size will default to medium.
   - To change the patient size, press the corresponding button.



Small medium large

=pediatric.

   - If the assigned parameters and techniques are appropriate, an X-ray exposure may be taken.
   - The default settings may be changed, if desired, before making an exposure. Please review Chapter 5.4.1 on the generator Touchscreen before making any changes. Changes made are not saved to memory. To make and then save APR changes, refer to chapter 12.

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NOTE: The factory-default x-ray technique factors must be confirmed as being suitable for the application. These should be edited as required, with the updated technique factors saved as per Chapter 12.

3. If the appropriate procedural item (**P** beside the item) is shown on the selected menu, select that item. A submenu will appear showing one or more APR items within that procedure.
   APR items within a procedural menu will be automatically selected in sequence. For example, assume that the procedural item FOOT contains the three APR items FOOT AP, FOOT LAT, and FOOT OBL.
   - The first item on the list (i.e. FOOT AP) is automatically selected. The selection will be highlighted, and predefined parameters and techniques will be assigned for that study.
   - An X-ray exposure may be made as per step 2.
   - When the exposure is finished, the APR will advance to the next APR item (i.e. FOOT LAT). That selection will be highlighted, and predefined parameters and techniques will be assigned, readying the generator for that study.
   - Another X-ray exposure may be made.
   - If an exposure needs to be repeated (i.e. FOOT LAT), reselect that item, and repeat the exposure.
   - The generator will advance to the last item (i.e. FOOT OBL). The last X-ray exposure may be made.
4. If the appropriate menu item, i.e. SKULL, (**M** beside the item) is shown on the selected menu, select that item. A submenu will appear showing one or more menu, procedural, or APR items within that category.
   - Menu items may be nested. It may be necessary to drill down through several submenus to find the desired procedural or APR item.
   - The appropriate procedural item or APR item may be selected as per the previous steps.
   - Menu, procedural, and APR items may be programmed to suit your requirements. Refer to Chapter 12 for details.
5. Press the **BACK** button to back out of the APR menu structure. A new region of interest may be selected at any time by pressing the appropriate area on the anatomical figure on the touch screen display as in step 1. It is not necessary to back out of an existing menu first.

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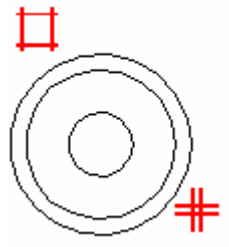
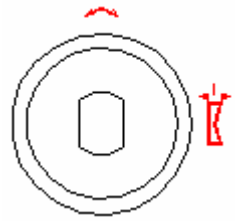
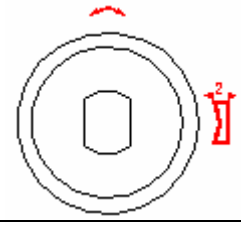
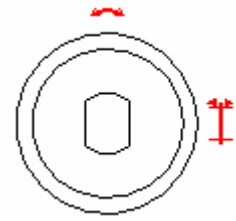
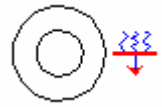
5.4.2 CONTROL PANELS

The two control panels are identical, yet one is mounted on a pedestal in order to be able to use it close to the GE Precision MPi.
When not specifically mentioned below, all joystick movements will not change from PA to AP positioned II and tube or from right to left mounted patient table.

The numbers in the left column refer to the drawing on the page after the description of the control panel layout;

1		Joystick for **collimator square shutter control**. The joystick makes the following movements within the limits set by the system: Joystick to the right: Closes vertical shutters Joystick to the left: Opens vertical shutters Joystick upwards: Opens horizontal shutters Joystick downwards: Closes horizontal shutters The collimator shutters can be manually set only to field sizes smaller than those set automatically.
2		Joystick for **Cardiac Filter 1** The joystick moves rounded filter no. 1 into the image area by moving the joystick to the right. Moving the joystick to the left will move the filter away from the image area. By turning the joystick the filter can be rotated in any direction.
3		Joystick for **Cardiac Filter 2** The joystick moves rounded filter no. 2 into the image area by moving the joystick to the left. Moving the joystick to the right will move the filter away from the image area. By turning the joystick the filter can be rotated in any direction.
4		Joystick for **Metal Strip Filter** The joystick moves the strip filter into the image area by moving the joystick to the left or to the right. Turning the joystick will rotate the filter in any direction.
5		Toggle button for choice of **spectral filter.** GE Precision MPi is constructed with 3 different spectral filters with the following values and one void: 1. 0 mm Al, 0 mm Cu 2. 1 mm Al, 0.1 mm Cu 3. 1 mm Al, 0.2 mm Cu 4. 2 mm Al, 0 mm Cu The spectral filter presently in use can be seen on the generator touch screen in the control room on the positioner information line and on the

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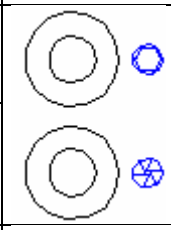
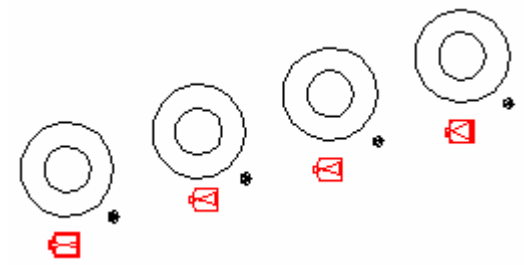
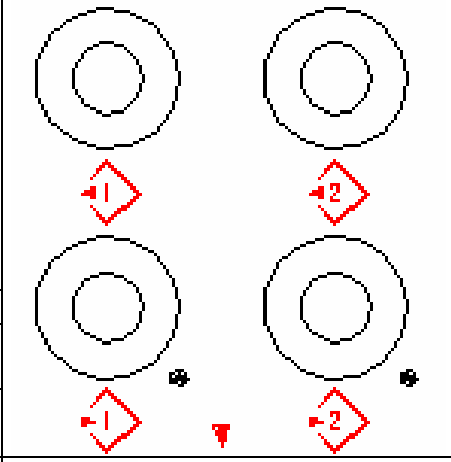
		positioner information monitor on the positioner. Pressing the button once will change the spectral filter to the next size in numerical order from 1 to 4. When filter no. 4 has been reached, pressing the button again will go through all filters backwards to no. 1.
6		**Iris open**. Pressing the button will open the iris diaphragm
7		**Iris closed**. Pressing the button will close the iris diaphragm
8		Button and indicator for smallest possible **Image Intensifier format (3)**
9		Button and indicator for medium **Image Intensifier format (2)**
10		Button and indicator for medium **Image Intensifier format (1)**
11		Button and indicator for largest possible **Image Intensifier format (0)** Note: To reset the positions of the collimator blades (except the metal strip filter) change II format (magnification mode).
12		**Stored positions** Two buttons store the present positioner position as position 1 or 2. A LED is lit after the position is stored. Pressing the recall buttons will recall the corresponding stored position (1 or 2). The stored positions are erased when the system is switched off and when another position is stored on that button. **Recall memory position 1**
13		**Recall memory position 2**
14		**Store current position in Memory 1**. A LED indicates a stored value in Memory 1
15		**Store current position in Memory 2**. A LED indicates a stored value in Memory 1
16		Button for **collimator light / Image Intensifier touchguard light.** When the C-arc is positioned with the tube and collimator above the patient table, pressing the button will activate a lamp in the collimator which will light the entire field of the X-ray beam without using radiation. The light remains on for 30 seconds. When the C-arc is positioned with the Image Intensifier above the patient table, pressing the button will activate two laser lines that form a light cross in the middle point of the X-ray beam

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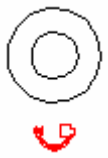
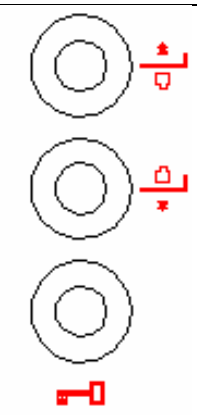
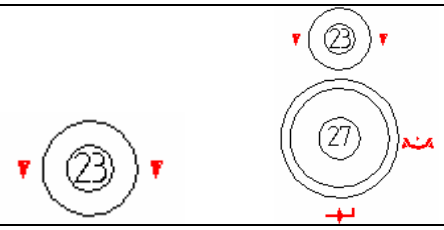
		without using radiation (only if the option of laser light has been installed). The light remains on for 30 seconds. If laser light is not installed, there will be no light indicating the centre of the X-ray beam when the Image Intensifier is above the patient table.
17		Button for **centering of C-arc and patient table** to a vertical beam direction
18		Button for movement of **C-arc to horizontal (lateral) beam direction**. Pressing the button will rotate the C-arc to 90° and move the patient table fully forwards towards the operator
19		**'Key switch'** for use in combination with button 20 or 21 for choice between AP and PA position The key switch is to keep pressed while activating either of the buttons for AP or PA choice. This is for safety reasons in order to avoid accidental activation of the change **WARNING:** None of the accessories that can be used on the positioner contain any anti collision features. Therefore, the operator must be very attentive to avoid collision during AP/PA mode change when any accessory is used on the GE Precision MPi.
20		Button for choice of **PA position**. Activating this button in combination with the key switch will activate a change of the C-arc position to PA projection position. **WARNING:** Do not activate this button when a patient is on the patient table
21		Button for choice of **AP position**. Activating this button in combination with the key switch will activate a change of the C-arc position to AP projection position. **WARNING:** Do not activate this button when a patient is on the patient table
22		Spare – Not used
23		Button for **patient access position**. Pressing this button will move the patient table downwards to the lowest possible position. Note that the C-arc will move as well in order for the table to move as close to the floor as possible

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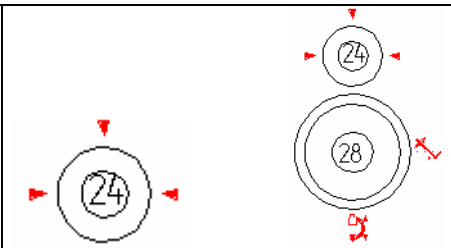
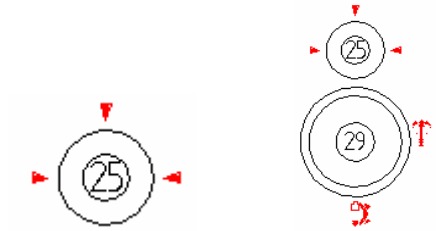
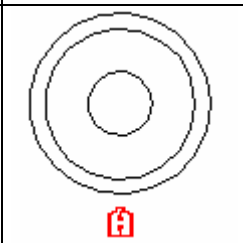
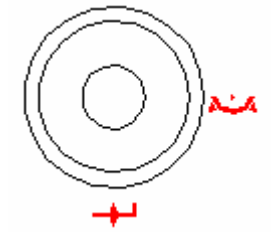
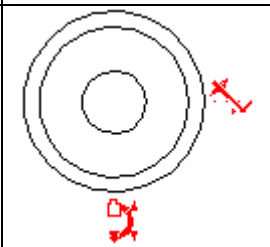
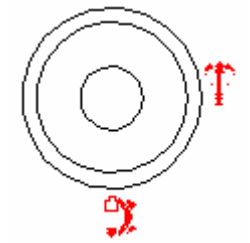
24		Button for **centering of Main Arm Tilt and for Patient table Tilt** movement
25		Button for **centering of C-Arc Tilt and C-Arc Rotation** movements
26		Joystick for **Image Intensifier Elevator up/down**. Moving the joystick upwards will move the Image Intensifier away from the patient. Moving the joystick downwards will move the Image Intensifier closer to the patient **Note:** When the C-arc is in **AP position**, moving the joystick upwards will move the II closer to the patient and downwards will move will move the II away from the patient
27		Joystick for **Patient table Up/Down and Patient table Lateral Tilt movements.** Moving the joystick to the left/right will cradle the patient table in +/- 20° Moving the joystick upwards/downwards will move the patient table upwards/downwards accordingly
28		Joystick for **Main Center Up/Down and Main Arm Tilt movements** Moving the joystick to the left will tilt the patient table counterclockwise Moving the joystick to the right will tilt the patient table clockwise Moving the joystick upwards/downwards will move the C-arc with patient table upwards/downwards accordingly
29		Joystick for **C-Arc Tilt and C-Arc Rotation movements** Moving the joystick upwards will rotate the C-arc to 90° LAO Moving the joystick downwards will rotate the C-arc to 45° RAO Moving the joystick to the left/right will angulate the C-arc from -45° to +45° **Note:** When the C-arc is in **AP position**, moving the joystick upwards will rotate the C-arc to 45° RAO and moving the joystick downwards will rotate the C-arc to 90° LAO

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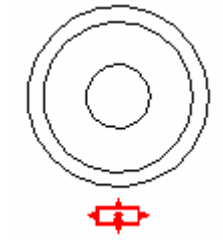
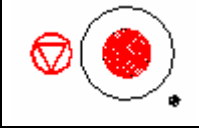
30		Joystick for **Longitudinal Scan and Patient table In/Out movements**. Moving the joystick to the left/right will move the C-arc along the length of the patient table. Moving the joystick upwards will move the patient table inwards laterally away from the operator Moving the joystick downwards will move the patient table outwards laterally towards the operator
31		Flashing light indication of **image intensifier or collimator collision** with patient/patient table. Pressing the button will start anti-collision movement
32		**Emergency Stop** will stop all motorized movements and all electrical power to the positioner will be shut off. Ongoing irradiation will continue.

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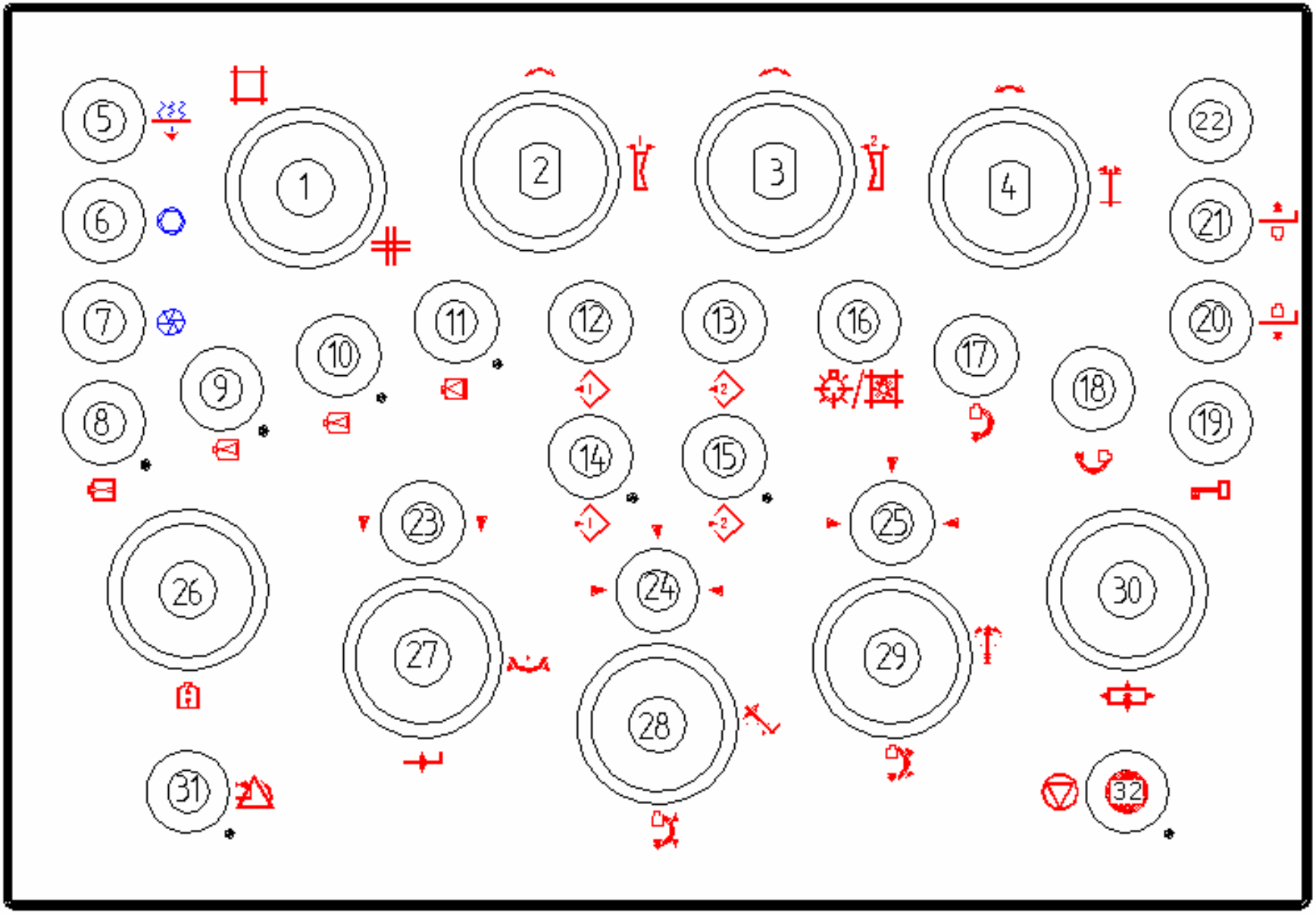

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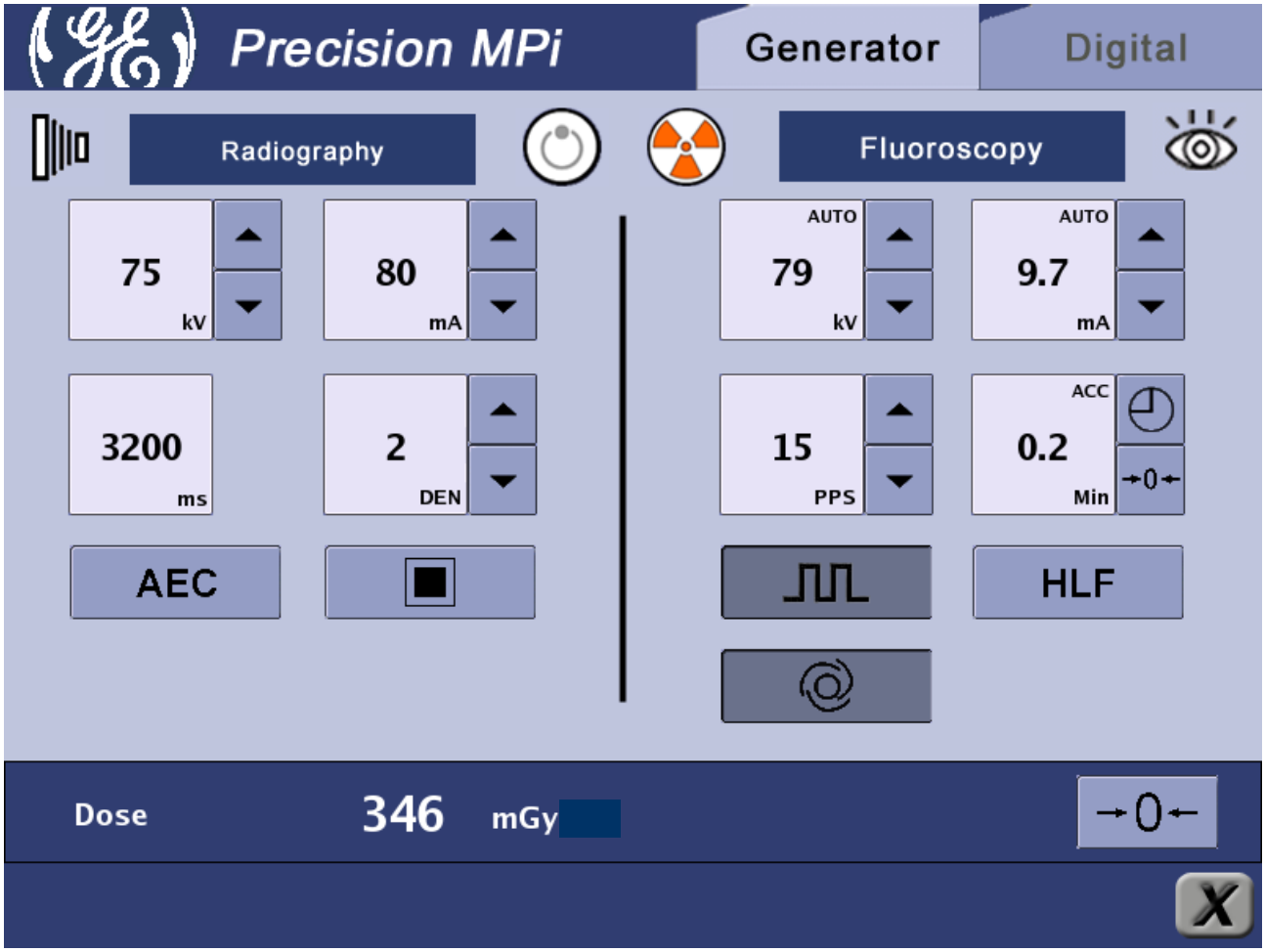
5.4.3 REMOTE TOUCH PANEL

The remote touch panel brings basic monitor and control functions of the generator and the DIS together into a single remote application.

5.4.3.1 Complete Generator Window and Functions

The window below shows the generator control and status functions.



Shut Down button
Press this button to power down the RTP and press Yes to Exit the application. The RTP will go through a Shut Down procedure and will power down automatically.

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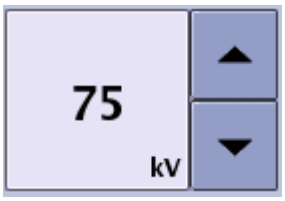
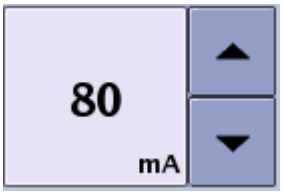
5.4.3.1.1Radiographic Control and Display Functions



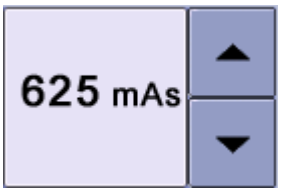
kV up/down step control
An increment and decrement button for the generator kV setting.



mA up/down step control
An increment and decrement button for the generator mA setting.

ms / mAs up/down step control
An increment and decrement button for the generator ms / mAs setting.

Displays ms when mA/ms is selected
Displays mAs when mAs is selected
Displays AEC or shows the AEC backup ms or mAs in AEC mode.



mAs / Dose up/down step control
An increment and decrement button for the generator mAs / Dose setting.

Displays mAs when mA/ms is selected
Displays Dose when AEC is selected

Technique select button
This function may be disabled in programming.
Press the technique select button until the desired technique is selected.

- **AEC** for Automatic Exposure Control (1 point technique)
- **mAs** for mAs technique (2 point technique)
- **mA/ms** for mA technique (3 pint technique)

Focal spot select button
Press the focus select button until the desired focal spot is selected (small/large focus)

This function may be programmed for auto focal spot selection.

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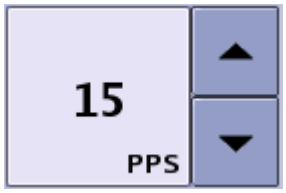
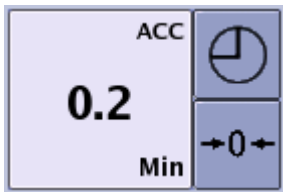
5.4.3.1.2Fluoroscopy Control and Display Functions

kV up/down step control
An increment and decrement button for the generator fluoro kV setting.

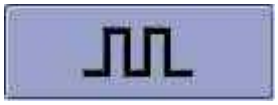
mA up/down step control
An increment and decrement button for the generator fluoro mA setting.



Pulsed Fluoro Acquire Frame Rate
An increment and decrement button for the generator fluoro pulse rate. The step cycles through 3.5, 7.5, 15 pulses per second.
This is only enabled when Pulsed Fluoro is selected.



Fluoro Timer
The accumulative fluoro time is displayed and can be set to a maximum time and is able to zero out the counter.



Pulsed Fluoro select button
Press to select pulsed fluoro.
This is only active for optional pulsed fluoro.
When enabled the button will be shaded to indicate it has been depressed.

High Level Fluoroscopy (continuous fluoro)
This is a toggle button that enables continuous fluoro mode on the generator. When enabled the button will be shaded to indicate it has been depressed.

ABS ON/OFF selection
This is a toggle button that is used to switch between manual mode for setting the kV / mA and auto brightness stabilization. When enabled the button will be shaded to indicate it has been depressed.

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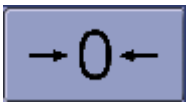
5.4.3.1.3Patient Display Data

Patient Dose data
The dose information in mGy is displayed in a status display.



Dose Reset
A button must also be available to reset the dose status value.

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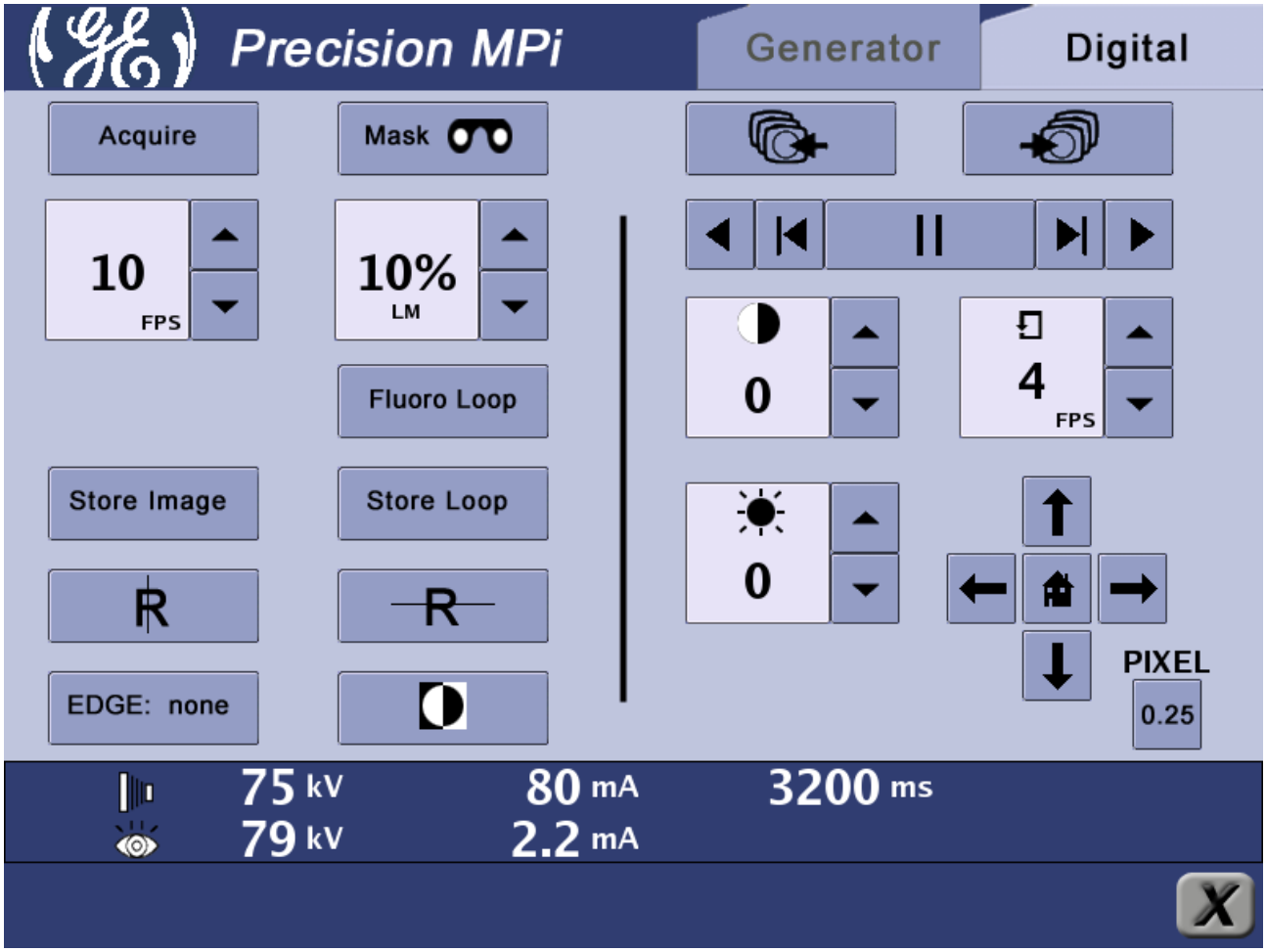
5.4.3.2 Complete DIS Window and Functions

The window below shows the DIS control and status functions.



5.4.3.2.1 DIS Control Functions

Acquire Button

This button places the DIS into acquire mode. Note the DIS must have a patient opened before this mode can be achieved. Once the Acquire button is selected, images are (at the selected rate) captured into a memory cache and stored to the DIS database. The DIS will stay in the acquire mode until the patient record is closed on the DIS or until the acquire button is pressed again. The button must therefore behave as a toggle.

Mask Button (toggle)

The toggle mask button is used to turn on and off mask image subtraction. A single touch on the button turns the mask on and off. The predetermined methods set up on the DIS for the applying the mask to Fluoro and Photospot acquisition will be used.

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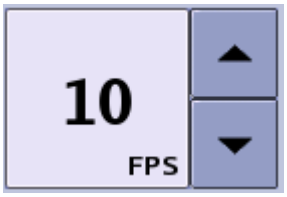
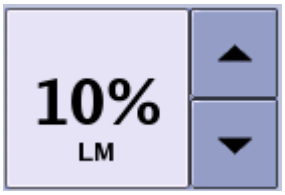
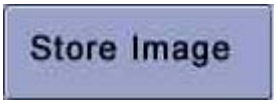


Pulsed Fluoro Acquire Rate
The Acquisition Rate controls the rate at which images are acquired and are measured in frames per second (fps). This will be a step button used to cycle through available pulse rates (3.5, 7.5, 15, 30 fps) and select a new rate.



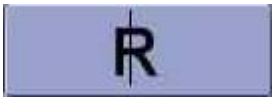
Landmarking
A small amount of the mask image is added back to the subtracted image. Landmarking is usually performed to assist the doctor in preparation of invasive procedures. The landmarking control button will step through 0%, 10%, 50%, and 100%.

Fluoro Loop
This button activates Fluoro Loop

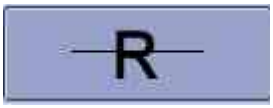


Store Last Image Hold
This button provides the capability to selectively store LIH (Last Image Hold) images to the system's database. The last single image (fluoro or spot) is stored when this button is pressed.

Store Fluoro Loop
This button is used to store the current Fluoro Loop to the database. Images will be stored to the local database at the selected acquisition rate for as long as the button is held.



Horizontal Reverse Button (toggle)
The H-Reverse is used to control the horizontal orientation of the image acquisition. If the button is selected during an Acquire mode, the next acquired image will be reversed in orientation. If the button is selected during Image Review or Online Review mode, the current image will not be changed, but the system will reverse the next image that is acquired.



Vertical Reverse Button (toggle)
The V-Reverse is used to control the vertical orientation of the image acquisition. If the button is selected during an Acquire mode, the next acquired image will be reversed in orientation. If the button is selected during Image Review or Online Review mode, the current image will not be changed, but the system will reverse the next image that is acquired.

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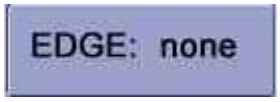


value set to none

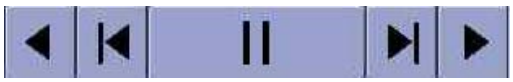
Edge Enhancement (step)
This button is used to select the desired level of Edge Enhancement. The higher the level of Edge Enhancement applied, the sharper the contrast within the image. There are five possible settings: None, 1, 2, 3, and 4. Higher setting equates to more filtering.

Invert Button (toggle)
This button is used to change the polarity of the image. An image captured in white contrast will be changed to black contrast and vice versa.

5.4.3.2.2Review Buttons

These buttons relate to review functionality on the DIS.

Next Run / Previous Run
There are two half buttons used to advance forward to the next sequence or backwards to the previous sequence. The buttons will only allow single clicks (advances) even if buttons are held down.



Loop Replay Controls
These buttons control loop replay on the DIS. The cluster of buttons supply functions for play in reverse direction, step single frame in reverse direction, pause, step single frame in forward direction, and play in forward direction.

Window - Up/Down
This button is used to increase and decrease the window settings. Holding down the up or down button will increase or decrease the value until the button is released.

Loop Replay Rate
This button is a step control that sequences through the valid replay rates of .5, 1, 2, 3, 4, 5, and 6 frames per second.

Level - Up/Down
This button is used to increase and decrease the window settings. Holding down the up or down button will increase or decrease the value until the button is released.

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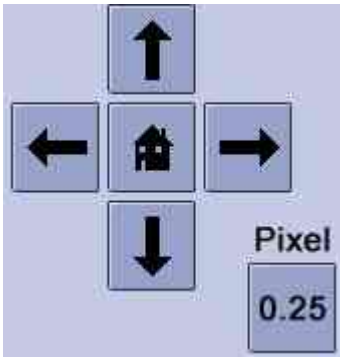

Pixel Shift Buttons
This button is used to move the mask pixel-by-pixel if a subtracted image is not properly aligned with the mask image. The mask can be shifted using the arrow keys. The center “pixel” display button is a step button that cycles through the granularity of the shift (1/10, ¼, ½, 1) and doubles as a reset (re-home) function when held down for 2 seconds.

5.4.3.2.3 Information display

Generator value information

This displays the values set in the Generator window.

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5.4.4 DIGITAL IMAGING SYSTEM KEYBOARD

ESC Escape
F1 Digital Imaging System User Manual
F2 Patient List
F3 Close Active Patient
F4 Toggle Acquire
F5 Acquire Subtracted
F6 Fluoro Loop Acquire
F7 Review Mask
F8 Not used
F9 Store reference
F10 Display Status Dialog
F11 Full Screen Mode
F12 Show/Hide Thumbnails
↵ Enter – Confirms a keyboard entry or election
Back Space deletes text during annotation

The Keyboard is used during several modes of operation, including:

- The alphanumeric keys are used to enter text data such as patient or doctor information, and for study and technique data.
- The ENTER key can be used to accept the highlighted menu choice (similar to a single click on the pointing device).
- The TAB key can also be used to move from field to field.
- The up/down arrow keys can be used as an alternative to the pointing device to highlight different menu options and perform various cursor movement functions.

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5.4.5 DIGITAL IMAGING SYSTEM POINTING DEVICE

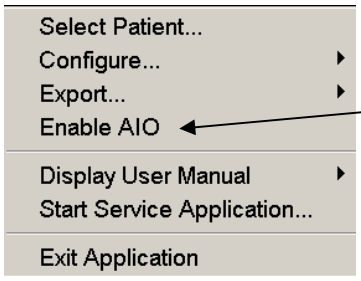
The Pointing device (a mouse) is used to control the Graphic User Interface (GUI) including:

- Cursor Movement
- Single-click selection on menus and screens
- Double-click selection on menus and screens
- Select and Drag items on screens
- Right click selection for alternate menus and screens

Right-click menu

To access this menu, click the right mouse button while the cursor is over the main image area. This function is operational in the *Review* or *Acquisition Mode*.

NOTE: User can bring up the standard right-click menu only when no image is replaying.



Enable AIO is optional and will appear only on the menu if AIO has been configured in Doctor Preferences (spot) and a spot image is currently viewed.

Standard Right-Click Menu

Menu Option	Display	Functions
Select Patient...	Will jump to the ***Patient List*** screen	Useful way to go to Patient List screen in order to open new patient, edit patient information, open Worklist, DICOM or Media Import, check status of study, etc.
Configure.. ▸	Doctor Preferences Current Doctor Prefs Programmable Sequences Sequence Titles Annotation Presets	Quickly change Doctor Preferences, Sequence Titles and Annotations. See chapters 4 and 7 for details. If a patient is open Doctor Preferences is grayed out and Display LUTs may be shown at the bottom.
Export... ▸	Export Frame (.BMP) Export Frame (JPEG) Export Sequence (.AVI) Export Frame to Clipboard	Save patient images as bitmap, jpeg or AVI format. Additionally, can copy an image to the clipboard for insertion in document or web page. See chapter 8.11 for details. NOTE: This button is accessible only when saved image is displayed.

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Menu Option	Display	Functions
Enable AIO **or** Disable AIO	Select Patient... Configure... Export... Disable AIO Display User Manual Start Service Application... Exit Application	If image was acquired with AIO in Doctor Preferences (Spot), additional text will appear on the right-click menu – Enable or Disable AIO. Refer to chapter 4.3.1.3 for additional information about this feature. **NOTE:** If image was not acquired with AIO, the Enable/Disable AIO button will not appear on the right click menu.
Start Service Applicatio	Closes current patient (if open) and then closes clinical application	You will be prompted for a login and password if current user is not authorized. When correct login and password is entered, the service screen is displayed.
Display User Manual	Will jump to DIS user manual (Note: Not the same structure as this manual)	Select desired chapter of the manual and it will open in Adobe® Acrobat .pdf format. When done with Manual, close window. System will return to System screen. Any open clinical images remain available and unaffected.
Exit Application		Click to exit the Digital Imaging System operation as part of normal shutdown procedure. If a patient file is open, the system will prompt you to confirm closing of the patient file. The system will also prompt for confirmation of action to exit the application.

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5.4.6 DIGITAL IMAGING SYSTEM MONITOR

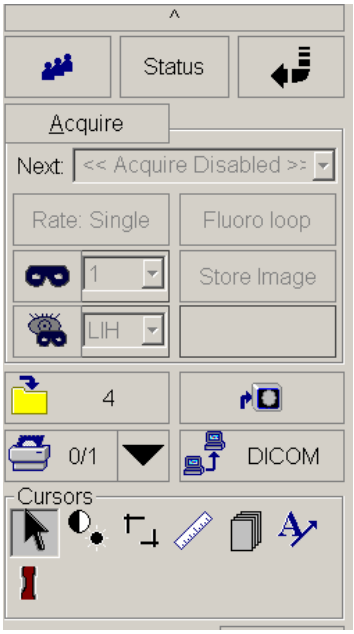
Use this section as a quick reference guide to function buttons, sliders, icons, cursors that appear within the various Digital Imaging System user interfaces. Buttons reflect features that are either universal to the Digital Imaging System or that have been enabled on a specific system. Buttons for features that are not enabled will not appear on the user interface of an actual system.

Standard Control Box

The ***Standard Control Box*** is located in the upper-left corner of the Control Room Display. This box is used during initial patient set-up, acquisition, printing and image transfer. Descriptions of function buttons will be discussed in the appropriate sections.

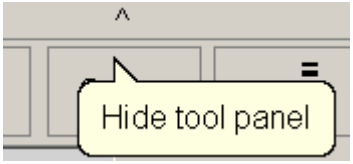
The **Cursor Tool bar** contains image processing cursors that when selected place the system into the mode of performing that image processing function. Position the cursor over the button to display annotation that identifies the function.

The Digital Imaging System RF/DSA version offers additional acquisition and review features and buttons and icons for those features will be displayed on the ***Standard Control Box*** only if specific features are installed on the system.



Standard Control Box – RF/DSA

5.4.6.1 Standard Control Box – Definitions

	Hide Tool Panel – Located at the top of the Standard control box, clicking on this arrow (^) will eliminate the tool panel display from the screen, leaving only the image and selected features displayed. Feature selections are superimposed on the right side of the main image screen
	Show Patient List Button – Click to access patient files or to create a new patient.
	Click to access information regarding status of image transfer either in process or completed. This screen will also indicate software version and serial number of system.

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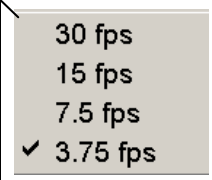
	Close Active Patient Button – Click to exit current patient file. OR if no patient file is open, selecting this button can be used to exit the DIS application
	Click to activate image acquisition functions.
	Click to show sequence titles
    	The Acquisition Rate controls the rate at which images are acquired and are measured in frames per second (fps). To select a value, left-click once on Rate button (Default = Single). Select appropriate value and left click. A check mark will appear next to rate selected and the rate will be indicated on active button. The active rate will also be displayed in the upper right corner of the Main image screen. Click to select Fluoro Loop feature Left Click **Rate** to Display Options Select appropriate value and left click. A check mark will appear next to rate selected and the rate will be indicated on active button. Selected rate will be displayed in Rate Box The active rate will also be displayed in the upper right corner of the Main image screen. **NOTE:** Rate menu is only activated when system in acquire mode.
	Store all images in the loop to the hard disk
	Click to store Current Image
	Roadmapping on/off drop down menu allows means by which to acquire mask. See Chapter 6.2.1.2.
Photospot Acquisition & Display	Select the Acquire button on the Main Image screen. This button will remain active until selected again.

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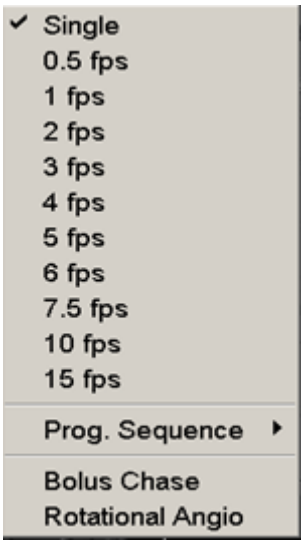
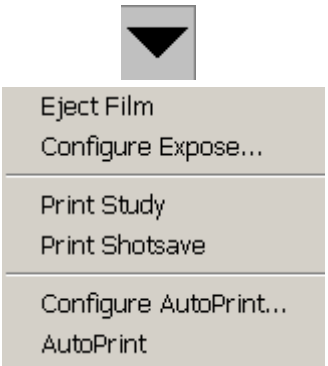
	Rate: Single Left Click to Display Options  Selected rate will be displayed in Rate Box Note: Bolus Chase and Rotational Angio will be shown on DSA systems only if the functions have been activated.
	Click to create Shotsave Image Any image that is processed See chapter 7.4
	Click to create Reference Image Any image to be maintained on the second monitor. See chapter 7.12
	Show Print Dialog- Left Click on Print button to display print function
	Click to display Send Options from drop-down menu

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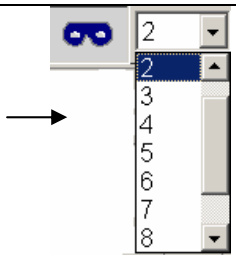
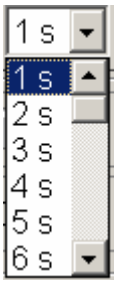
	Click to select current Image as mask. Use drop-down menu to select frame number **NOTE:** This feature is only available on DSA systems.
Click to activate: Button changes: Selected setting: 	To accept or change setting displayed in Injector Settings, click OK and click the button again. If this selection is correct or another is required, click OK again. Continue this until the correct setting is found. To select Injection Delay time in seconds click to select time.  Using down arrow, selects delay time in seconds **CAUTION**: Ensure and observe manually that injector is correctly armed and ready before and during the process. **NOTE:** This feature is only available on DSA systems.

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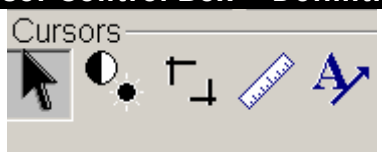
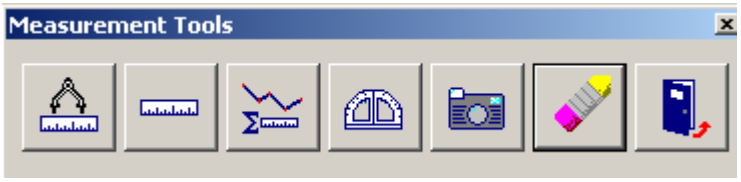
5.4.6.2 Cursor Control Box

The Digital Imaging System offers a flexible selection of interactive cursors to be set to customize specific images being acquired. These icons are reactive to the display format chosen.

Cursor Control Box – Definitions	
 **RF Cursor Tool Bar** Some of the cursor button functions are used only during the image acquisition process while others are used during image review and processing. Additional cursors are displayed for optional DSA features.	
	Restore Standard Cursor
	Use Mouse to set brightness and/or contrast See Chapter 7.7.
	Manually apply or adjust Shutters See chapter 7.11 – Electronic Shutters for more details
	Use Measurement Tools – Offers several options for applying measurement tools to image. Click on to display selection window:  See chapter 9, - Measurement Functions
	Add/Edit Annotations on an image See chapter 7.13 – Annotations

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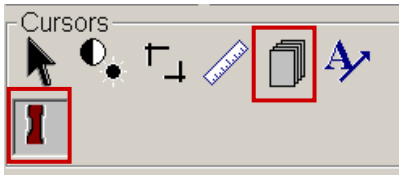
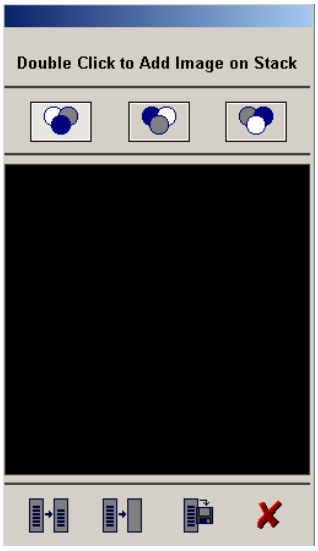
DSA Only	
 **DSA Cursor Tool Bar**	
Image Stacking	Use *Image Stacking* to consolidate a series of images into a single image showing the blood vessel completely filled with contrast media. The term Image Stacking is used as a general term covering the following specialized features Average, Maximum Opacification, or Minimum Opacification. As each image is added to the window, the composite image will be updated to reflect the addition of the new image.  See chapter 7.16 – Image Stacking
QCA Processing	The Digital Imaging System offers a software feature that allows for the measurement of the size of the vessel in order to determine the width and length of the stenosis. Using the catheter as a calibration reference, an accurate measurement can be made of the size of the vessel in order to determine the size of the balloon or stent to be used.

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QCA Feature Screen

See chapter 9 – Measurement Functions for detailed instructions on the QCA (Quantitative Analysis of Coronary Arteriograms) function.

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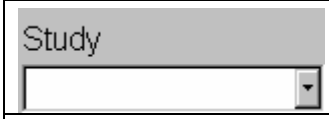
5.4.6.3 Expanded Control Box

The Feature Processing Panel includes icons that activate a variety of feature processing functions. Position cursor over button to display annotation identifying function.

Image Review Function Buttons

Image Processing Function Buttons

5.4.6.4 Image selection

	Click to show study titles
	Click to display Thumbnails. If thumbnails are currently displayed. Click to display Expanded Control Box.
	Click down arrow to display next series of thumbnails. ***Or*** Click up arrow to display previous series of thumbnails.

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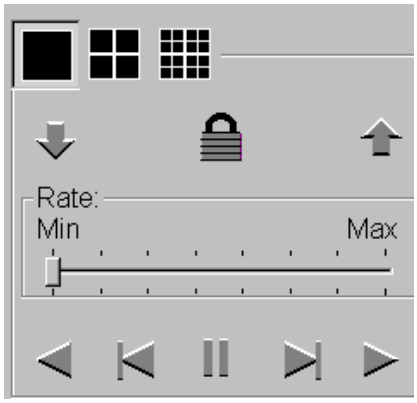
5.4.6.5 Image Review Function Buttons



	Set Full Screen Display
	Set 2X2 Multiple Image display
	Set 4X4 Multiple Image display
	Show Next Sequence
	Set Loop Lock on See Chapter 7.2.1
	Show previous sequence
	Replay Rate slider control.
	Play Backwards
	Back One Frame
	Pause Replay
	Forward One Frame
	Play forward

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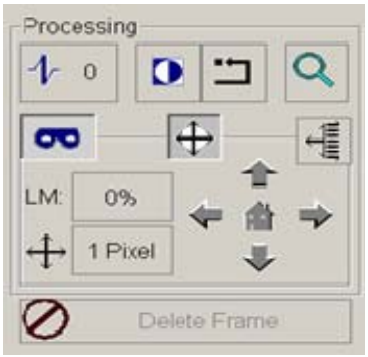
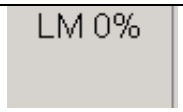
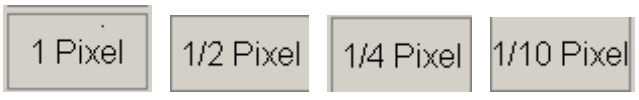
5.4.6.6 Image Processing Function Buttons



	Change Edge Enhancement - The active edge setting (by image type) will remain active for subsequent image acquisition or image review until changed. Select the appropriate button from GUI Control Box for required level of Edge Enhancement. See Chapter 7.9
	Click to Reverse Display Contents (Polarity) See Chapter 7.8
	Select to apply Default brightness and contrast
	Click to start Zoom
	Click to select Current Image as mask or input number
	Click to set Landmark percentage See Chapter 7.18
	Set Pixel Size – Click on button to select 1 Pixel, ½ Pixel, ¼ Pixel or 1/10 pixel size. Label on button changes to reflect selection: 

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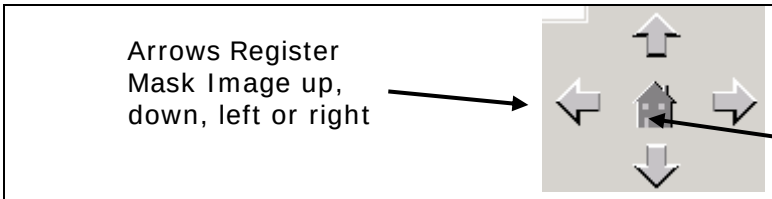	
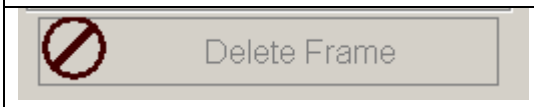	This feature allows an individual image to be marked for deletion. Option is available whenever the pointer cursor is active and the sequence thumbnails are displayed

BC/RA mode only	
3-state split Re-registration	Click to toggle between Re-registration modes: Full. Left or Right side only See Chapter 7.19
Carry-over	Click to Carry Over (copy) Re-Registration from one Mask to the subsequent mask images See Chapter 7.20

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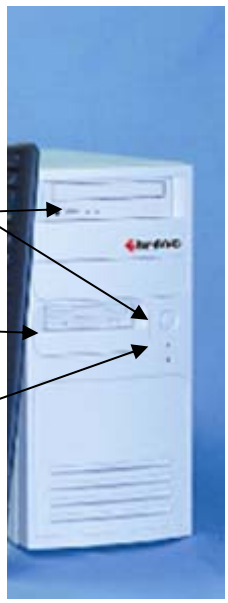
5.4.7 DIGITAL IMAGING SYSTEM CABINET

The digital imaging system is switched on by pressing

The system shuts down automatically when the Windows application is shut down.

Eject/Insert Compact Disc by pressing.

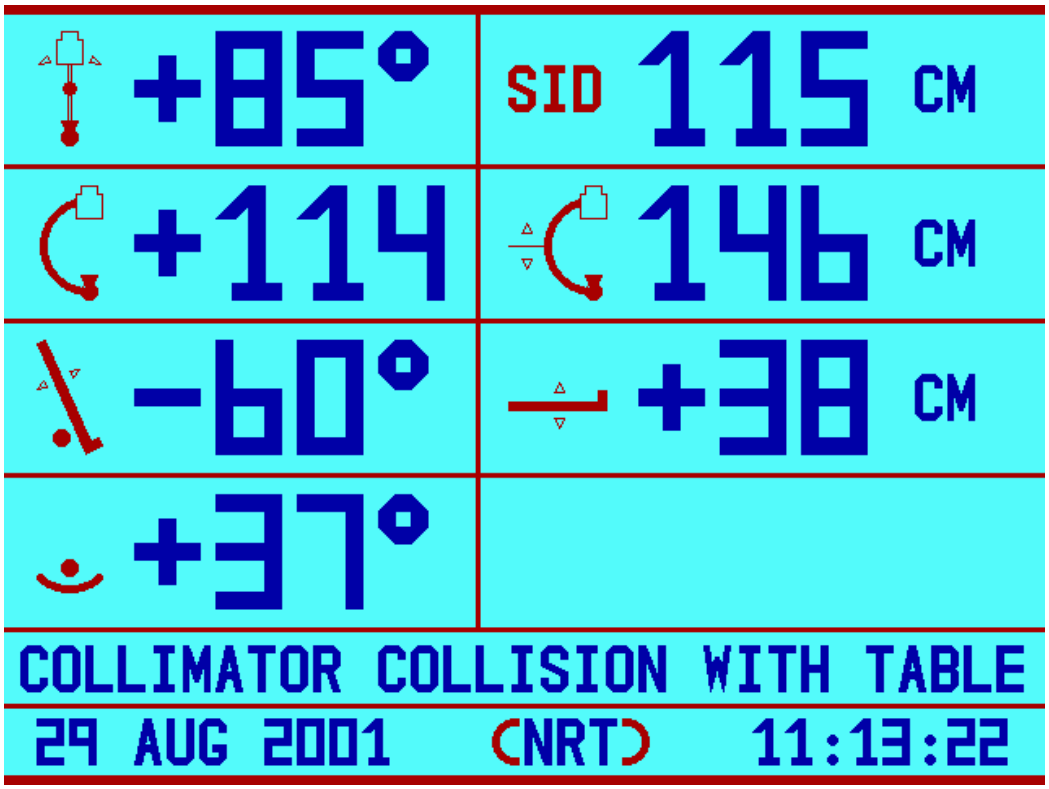
Eject Floppy disc by pressing. If no floppy disc is loaded, the button is hidden.



NOTE: Before switching off the system check that all relevant images have been archived.

CAUTION: Do not press the power button again during start-up as it may interfere with the start-up procedure.

5.4.8 POSITIONER INFORMATION MONITOR



The patient information monitor shows the position of 7 movements of the GE Precision MPi positioner.

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Filters: Shows which spectral filter is inserted in the collimator. Change the filtration manually on either control panel and toggle between the 3 filters and 1 void.

Guidance information: Describes the collision detected by GE Precision MPi. Clear the system from the collision as described in Chapter 2.2.2.

5.4.9 FOOT SWITCH / HAND SWITCH

Hand switch:

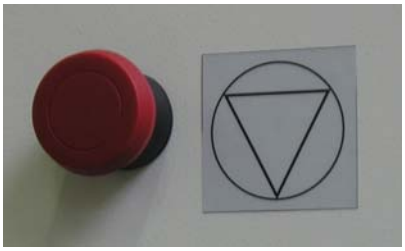
Press the hand switch halfway to the PREP position. This will spin the rotor. Fully depress and hold the hand switch in the EXPOSE position to make an X-ray exposure.

Foot switch:

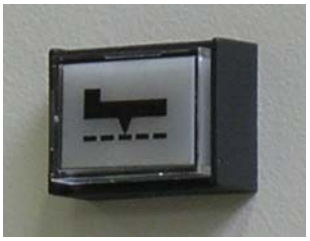
Fluoroscopic exposures are initiated by pressing and holding the left foot switch.
Radiographic exposures are initiated by pressing and holding the right foot switch.

5.4.10 POSITIONER EMERGENCY CONTROL

On the left side of the positioner (when seen from the front of the system):



Emergency stop
This will stop all motorised movements and all electrical power to the system will be shut off. Note that acquired images are not lost when this button is activated because neither generator nor the imaging system is powered off.



Locate the patient table down button on the left side of the base (when seen from the front of the system) next to the emergency power off switch.
Activate the **patient table down/security override** button on the left side of the positioner (when seen from the front) next to the emergency stop.
Activate the patient table down button and keep it pressed until the patient table has moved to its lowest horizontal position. This allows

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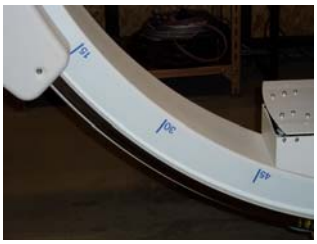
the patient to be released from the patient table which may be very important if the patient is positioned in a head-down position. Be sure to support the patient before releasing him/her from the patient table.
Note that the button has a collision-recovery function when the power is switched on. See Chapter 2.2.2. for a description of this function.

5.4.11 COLLISION DETECTORS

The system is equipped with different anti collision devices to protect the patient from being injured due to non-patient focussed operation of the equipment. The two anti collision devices are fitted to the collimator and the image intensifier as shown below:

5.4.12POSITIONER INDICATORS



C-arc rotation angle scale
A scale on the inside of the C-arc indicates its rotation. The position is also shown on the positioner information monitor.

Patient table lateral tilt angle scale
A scale on the arm of the patient table indicates the angulation of the patient table tilt angle. The position is also shown on the positioner information monitor.

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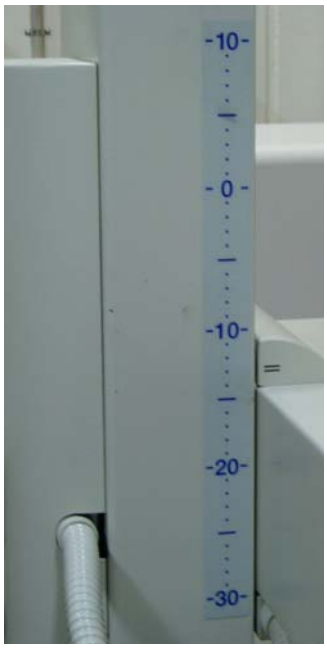

Patient table vertical scale
A scale on the inside of the patient table support indicates the relative position of the patient table. The position is also shown on the positioner information monitor.

5.4.13 POSITIONER ON/OFF

Located on the rear of the base unit on the left side when seen from the rear side is a positioner shut down button. This is used to switch on/off the positioner power, including cooling unit.
The switch is turned clockwise to power on and against the clock to power off the positioner.

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5.5 DOSE INDICATION

Dose indications on the generator touch screen and the in-room tableside touch panel are valid in the interventional reference point (IRP) which is 15 cm below the ISO center for the system (see chapter 2 for detailed decribtion of the IRP). Dose indications on this system comply with fda 21.1020.31 and IEC 60601-2-43.

5.5.1 DOSE DISPLAY

- The dose / dose rate Will be displayed when the generator is switched on.
- In RAD mode the system calculates and displays the dose (mGy/min) rate when the frame rate is equal to or higher than 6 frames per second. Cumulative dose values are displayed within 6 sec. from ending the procedure. It may be programmed to display dose values for each tube individually, or to sum the readings from both tubes. This is installer programmable.
- In fluoroscopy mode, the system displays the dose rate (mGy/min) when fluoroscopy is performed and the accumulated dose within 6 sec. from ending the procedure.
- Limits for dose / dose rate warnings can be adjusted. This adjustment needs technically assistance.

NOTE: A reading of 0 mGy indicates that the dose value has been manually reset as described later in this section, and that no exposures have been taken since it was reset.

NOTE: To maintain the accuracy in dose / dose rate calculations the system needs to be calibrated once every 6 month as scheduled in the planned maintenance manual.

5.5.2 DOSE VALUE RESET / PRINT

The dose value can be reset to zero and a label can be printed with the dose value and patient information as described below.

1. Press the >AK< button at the bottom of the touch screen display. This will present the dose reset / print menu.
   - Press **RESET** to reset the dose value display to zero. The display will reset, and the reset / print menu will close.
   - Press **PRINT** to open the dose printer interface window. The dose printer function is described in detail on the next page.
   - Making a selection from the reset / print window will automatically close the window, otherwise it will close in approximately 5 seconds.

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5.5.3 DOSE PRINTER INTERFACE WINDOW

The dose printer interface window is accessed via the **PRINT** button on the dose reset / print menu, as described on the previous page. This allows a label to be printed with the currently displayed dose value, and with patient information that must be entered manually.

1. From the printer interface window, enter the following information:
   - Enter the patient's gender by pressing **MALE** or **FEMALE**.
   - Press **NAME** to enter the patient's name. An English keyboard will pop up at the bottom of the screen. A partial keyboard with international symbols may be displayed at the top of the screen. To display the desired international characters, select the language of your choice from the list near the top right side of the screen. Characters may then be entered via either keyboard.
   - When finished entering the name, press **ENTER** on the bottom keyboard. The touch screen will return to the printer interface window, and the name will appear on the graphic of the label to be printed.
   - Follow the preceding procedure to enter the **ID #**, **TECH LINE 1**, and **TECH LINE 2**. Tech line 1 and tech line 2 are typically used to enter the techniques as appropriate for the record. A maximum of 25 characters may be entered per line.
   - Enter the patient's date of birth by pressing the up or down arrows to the right of the **MONTH**, **DAY**, and **YEAR**.
   - Press **CLEAR LABEL** to clear the label, if desired.

   BEFORE PRINTING:
   - Check all information on the graphic of the label to be sure it is correct. The date and time are inserted automatically. Confirm that the touch screen clock is set correctly to ensure correct printing of the date and time.
   - Ensure that the correct printer is selected from the **SELECT PRINTER** window. The generator will only be compatible with the selected printer.
   - Press **PRINT** when ready to print the dose label.
   - Pressing **CLOSE** will exit the dose printer interface window and return to the normal console operating mode.

NOTE: The paper or labels used in the printer must meet all applicable regulations. Medical grade paper or labels, approved for medical records, must normally be used.

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INTRODUCTION

Once a patient file has been set up, images can be acquired for that patient. This section is a guide to the features and functions available when acquiring images.
This section assumes that a patient file is open and a study selected as described in Chapter 4.1.

6.1 Exposure Factor Guidelines

NOTE: The DIS does not alter the operation of the x-ray generator. The technical factors on the generator are normally set in the same manner as previous to the installation. The system is calibrated to provide optimal imaging while striving to reduce dose. However, the GE Clinical Application Specialist may recommend revised technical factors for acquiring optimal digital images.

It has been proven that high quality digital images can be acquired with less exposure. The following guidelines are recommended. The system may be limited by generator capabilities.

6.1.1 Focal Spot Size

Use a small focal spot whenever possible to help increase resolution. However, this is dependent upon dose rates, generator capabilities, image intensifier capabilities and patient size.

Use CAUTION so that exposures are not routinely exceeding the tube limit, which can directly affect the life of the tube.

Under some circumstances a large focal spot may have to be used exclusively.

6.1.2 Exposure Time

In a normal connection – No RAD_EXPOSE_ON – the maximum exposure times are as follows:

Acquisition	Maximum Exposure Time
4 fps	200 milliseconds
5 fps	167 milliseconds
6 fps	133 milliseconds
7.5 fps	100 milliseconds
10 fps	67 milliseconds
15 fps	33 milliseconds

When RAD_EXPOSE_ON is connected, the exposure time is not limited to the frame rate since the generator controls overall exposure time.

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WARNING: In cases where images are too light or too dark the mA or KVP will need to be adjusted. Adjusting the backup time above the maximum listed on the chart will have no effect on image quality.

6.1.3 MilliAmperage (mA)

MilliAmperage selection is directly dependent upon the KVP selection and exposure time desired. Since optimal images are produced between 10-50 milliseconds it is important to set the mA selection at the appropriate level in order to produce exposures in the 10 - 50 millisecond range. Check the length of the exposure time (on generator control panel) after the first exposure, and adjust the mA if necessary.

High mA selection is recommended for angiography and/or subtracted images to shorten the exposure time and produce higher quality images.

6.1.4 Kilovoltage (kVp)

Kilovoltage selection is directly dependent upon the type of contrast medium injected and the subject contrast desired. Refer also to information inserts provided by contrast manufacturers for more information.

High kVp will result in low subject contrast images (long gray scale), and low KVP selection will result in high subject contrast (short gray scale). Perform DSA procedures using low kVp (60 - 80) and high mA to produce high quality images with high subject contrast and minimum patient motion.

Excellent-quality digital images are best achieved with settings of 100 kVp or less due to the inherent characteristics of the image intensifier and digital camera combination. Do not use120 kVp for most digital imaging systems.

Also, lower dose exposures are a significant advantage of digital systems, but when combined with high kVp cause inadequate exposure technique with many generators, due to insufficient exposure times.

6.1.5 Recommended Ranges

60-70 KV	Infant and Pediatric Studies
70-80 KV	a. Children and small adults b. Vascular Studies Other contrast injections (Myelos, Hystros, T-Tubes, etc.)
90-95 KV	Adult double contrast studies, Esophagus
90-100 KV	Single Contrast GI and BE Studies
100-110 KV	Large Patients

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6.1.6 Automatic Exposure Control (phototiming) vs. Manual Technique

Routine fluoroscopy procedures (unsubtracted) may be performed using either phototiming or manual technique selection. Phototiming is most often used due to the ease of operation. Proper exposure factor selection is just as important in digital imaging as it is in conventional imaging.

Please refer to the above guidelines for proper exposure factor selection.

Procedures which involve *Subtraction*, either during **Acquisition** or **Review** modes, will be of better quality if manual exposure selection is chosen over phototiming because more consistent exposures will be obtained, resulting in better end results for the subtracted images. The exposure times will remain constant but may vary if phototiming is selected due to a variety of factors; including inconsistent phototimers, tube heating, rotor acceleration, patient breathing and contrast injections. All these factors may cause variation in densities between exposures resulting in a decrease in quality of subtracted images.

If desired, phototiming may be used to determine proper manual exposure factors. Phototiming a scout image with appropriate mA and KVP selection, and reading the exposure time on the generator control panel after the scout images has been exposed, will provide the necessary information to select manual exposure factors.

Remember never to set the back-up time above the recommended ranges.

6.1.7 Recommended Doses

Field Of View	Continuous Fluoro	Pulse Fluoro	Spot (RF)	Spot (DSA)
16 Inch	20 uR/s	.9 uR/Fr	45 uR/Fr	100 uR/Fr
14 Inch	25 uR/s	1 uR/Fr	55 uR/Fr	125 uR/Fr
13 Inch	30 uR/s	1.1 uR/Fr	65 uR/Fr	150 uR/Fr
12 Inch	35 uR/s	1.2 uR/Fr	70 uR/Fr	170 uR/Fr
11 Inch	40 uR/s	1.4 uR/Fr	75 uR/Fr	200 uR/Fr
10 Inch	45 uR/s	1.8 uR/Fr	85 uR/Fr	240uR/Fr
9 Inch	50 uR/s	2 uR/Fr	100 uR/Fr	300 uR/Fr
8 Inch	63 uR/s	2.1 uR/Fr	120 uR/Fr	378 uR/Fr
7 Inch	82 uR/s	2.7 uR/Fr	145 uR/Fr	540 uR/Fr
6 Inch	112 uR/s	3.7 uR/Fr	200 uR/Fr	675 uR/Fr
5 Inch	162 uR/s	5.4 uR/Fr	275 uR/Fr	925 uR/Fr
4.5 Inch	200 uR/s	6.6 uR/Fr	350 uR/Fr	1100 uR/Fr

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6.1.8 Recommended Techniques for Digital Fluoroscopy Acquisition

The following techniques should be used as a guideline. Technique may need to be varied dependent on the generator type.

Automatic Exposure Control (phototime) is set to its highest sensitivity (all three AEC fields)
SMALL FOCAL SPOT IS *HIGHLY* RECOMMENDED FOR HIGHEST QUALITY DIGITAL IMAGING.

	EXAM	FOCAL SPOT	kV	mA	Ms/Sec
RF - Adults	Esophagram	Small	90	160/200	190/.19 or .2
	U.G.I.	Small	95	160/200	190/.19 or .2
	U.G.I. Obese	Large	100	250	190/.19 or .2
	Barium Enema	Small	105	160/200	190/.19 or .2
	Barium Enema Obese	Large	105	250	190/.19 or .2
	Gastro Enema	Small	95	160/200	190/.19 or .2
	E.R.C.P.	Small	75/80	160/200	190/.19 or .2
	H.S.G. (Hysterosalpingogram)	Small	75	160	190/.19 or .2
	V.C.U. (Voidingcysto)	Small	75	160	190/.19 or .2
	Arthrogram**	Small	65/75	100	190/.19 or .2
	Venogram**	Small	65/75	100/160	190/.19 or .2
RF - Peds	Baby Barium	Small	65/70	80/100	190/.19 or .2
	U.G.I. Child	Small	75/85	100/160	190/.19 or .2
	B.E. Child	Small	75/85	100/160	190/.19 or .2
	V.C.U. Child	Small	65/75	80/160	190/.19 or .2
ANGIO*	Abdominal	Small	75/85	160/200	190/.19 or .2
	Extremities	Small	65/75	50/80/100	190/.19 or .2
	Head/Neck	Small	65/70	160/200	190/.19 or .2

****Recommend Using Manual Techniques for these Exams**

Exposures should be between 10Ms-190Ms.
Optimal Exposures for Highest Quality Digital Imaging are within 20Ms – 60Ms

- Using a 12" I.I., adjust the mA to obtain these optimal exposure levels, I.E. lower mA to bring the exposure level up.
- Adjusting the kV will inhibit exposure levels for a darker image. kV rarely should be changed from the recommended techniques listed above.
- Under no circumstances shall NRT be liable for any direct, indirect, special, incidental or consequential damages resulting from following these guidelines.

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6.2 Acquiring Images

	This icon will display in the lower left corner of the **Main Image Screen** whenever Fluoro images are being acquired**.** Additionally, the Main Image Screen will reflect rates, doses, applied features and patient information.

6.2.1 Fluoro Acquisition & Display

6.2.1.1 Fluoro Loop

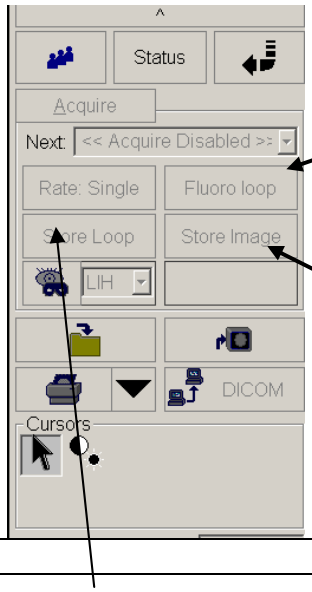
This feature allows acquisition and storage of multi-frame sequences of fluoro images (acquisition rate =1, 3.75, 7.5, 15, 30 frames per second). The maximum size for a Fluoro Loop sequence 165 images (for 512MB RAM)
When the maximum number of images is reached, new images begin replacing the oldest images (i.e. wrap-around).

Sequences acquired in this manner are only temporary unless manually stored to the local database. Subsequent fluoro exposures overwrite the previous sequence in memory, and only one sequence is held in memory at a time.

After Fluoro Loop is acquired, user can click Store Loop to save current sequence tot the database. Refer to the Fluoro and Store Loop chart in this Chapter.

CAUTION: **Do NOT attempt to acquire a new Fluoro Loop while the current one is being saved.** Once the function is complete, the icon will disappear and a new Fluoro Loop can be acquired

NOTE: Changing the Pulsed Fluoro Rate on the Touchscreen will automatically change the Fluoro Loop Acquisition Rate. Alternately, changing the Fluoro Loop Acquisition on the DIS GUI will change the Pulsed Fluoro Rate on the Touchscreen



1. To activate the Fluoro Loop feature, click the Fluoro Loop button on the Standard Control Box on the ***Main Image*** screen.

While this feature is activated, the **Store Image** button will be disabled (grayed out). This is to prevent storing single images while Fluoro Loop is in progress.

When the Fluoro Loop button is selected, the Acquisition Rates for spot change to Fluoro Loop Acquisition Rates.

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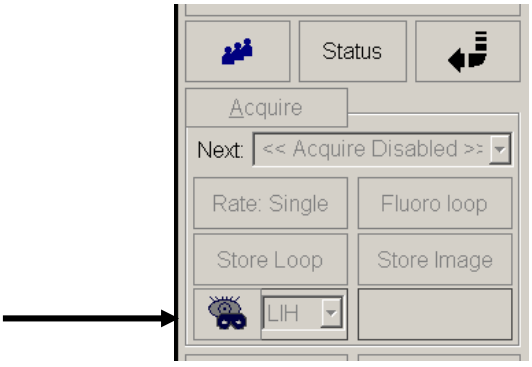
Store Loop	2. To store the current Fluoro Loop to the database, click on the Store Loop button at the ***Main Image*** screen. Alternately, press the store loop button on the in-room RTP. Images will be stored to the local database at the selected acquisition rate for as long as the button is held.
Store Loop in Process Icon	3. While the system stores the Loop of images to the database, an icon will display at the lower left of the ***Main Image*** screen.
Fluoro loop	4. When finished, click the Fluoro Loop button again to deactivate.

6.2.1.2 Fluoro Roadmapping

Roadmapping is an acquisition mode where the system subtracts one image from subsequently acquired images. Only the difference between the mask and each of the newly acquired images is shown.

Activating / Deactivating Fluoro Roadmapping

1. Left click .
2. The text within the dialog box will “light up” (change from gray to white).



There are three ways of selecting the image to be used as the mask image.

- LIH (using the Last Image Held on the screen)
- Max Opacification (DSA only)
- Min Opacification (DSA only)

Last Image Hold – Mask Acquisition

1. While producing fluoro radiation, inject the target vessel with a contrast agent
2. When the target area is full of contrast, release fluoro to obtain an LIH image
3. The resulting LIH image will be the mask
4. Activate fluoro again to acquire the roadmap image.

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Subtracted Acquisition	Producing fluoro radiation on a plane that has acquired a mask will result in subtracted display of the new fluoro images
Subtracted LIH	Releasing fluoro during subtracted display will result in a subtracted LIH image.

Max Opacification - Mask Acquisition

This feature provides for subtracted fluoro roadmapping display on the Primary In-room Monitor by utilizing a maximally opacified composite image created during contrast injection as the mask image.

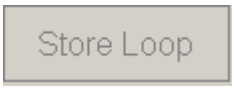
Min Opacification – Mask Acquisition

This feature provides for subtracted fluoro roadmapping display on the Primary In-room Monitor by utilizing a minimally opacified composite image created during contrast injection as the mask image.

6.2.2 Fluoro Video Bypass

When live Fluoro Video Bypass (Override) is active, any time Fluoro Radiation is active the images will display on the Primary In-room Monitor with no obstructing graphics or text. The live image will replace the current image. When Fluoro Radiation is terminated, the last complete image frame will become the new LIH image, if currently in the Acquire mode.

If in the Review mode, the live Fluoro Image will replace the current image. When Fluoro Radiation is terminated, the previously displayed image that was already stored to the disk will display again.



6.2.3 Photospot Acquisition & Display

Photo-spot sequences are acquired using the existing generator controls, such as a two-position footswitch or handswitch.

The first position activates “Prep” (Prepare for Expose) and the second position activates “Request for Exposure”.

As images are acquired (at the selected rate) they are all cached in memory and stored to the local database.

To stop Photospot acquisition, release the spot generator control switch.

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The system will remain in Acquisition mode and another photospot sequence can be acquired by reactivating the generator controls. There is no need to reselect the Acquire buttons.

NOTE: A New Patient will automatically be in Acquire mode. The procedure below only needs to be performed when you are appending to a Patient.

Select the Acquire button on the ***Main Image*** screen. Define either a new patient study or use an existing study. This button will remain active until selected again.

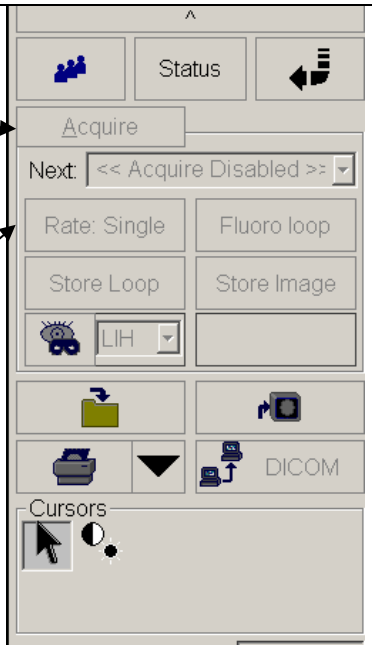
Left Click to Display Options (depending on how the system is configured:

Single, 0.5 fps, 1 fps, 2 fps, 3 fps, 4 fps, 6 fps, 7.5 fps, 10 fps, 15 fps, Bolus Chase and Rotational Angio.

Selected rate will display in Rate Box

A check mark will appear next to rate selected.

The active rate will also display in the upper right corner of the ***Main Image*** screen.



Selectable DSA Mask

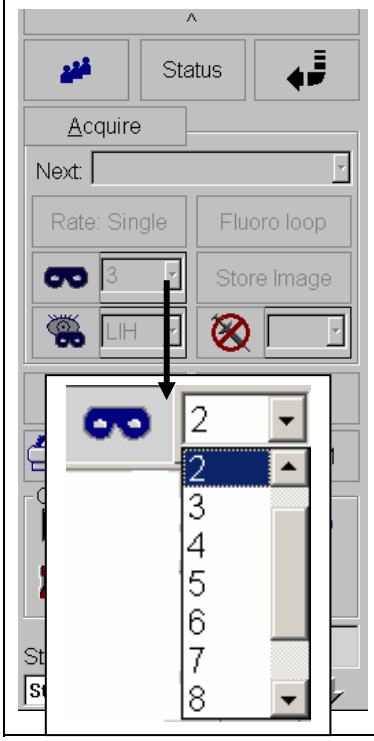


Photo-Spot sequences can be acquired as a **DSA** run. Enabling masked acquisition can also configure the image number, which is used as the mask.

Used as Doctor Preference

The default state of the **DSA** button and the default mask number can be configured as a Doctor Preference. The Doctor Preferences setting can be overridden using the ***Standard Control Box*.**

Using the Standard Control Box

When Photo-spot acquisition mode is selected on the generator, the *Standard Control Box* contains a **Mask** button. Click on for a list of frame numbers from which to choose image that will be used as a mask. The default state of these controls is determined by the Doctor Preference settings.

NOTE: This feature is only available on DSA systems.

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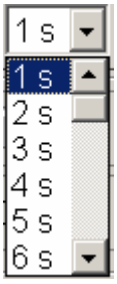
Injector Synchronization

Click to activate

Button changes (continue to left click button until the correct button for the mode you want to use is displayed.)



Using Down Arrow, select delay time in seconds (from 1-30 seconds).

Select The Injector Synchronization feature from the Standard Control Box. **Injector Sync does not work when the Rate is set at Single.**

There are four modes of injector synchronization:

- Off
- injector and exposure together
- injector leads exposure (X-Ray delay)
- exposure leads injector (Injector delay).

Injector Synchronization disabled

Injector and Exposure at the same time

NOTE: No time adjustment is available

Injector Delay enabled

X-Ray Delay enabled

Between each possible setting an Injector Settings box appears to indicate what has been selected. To accept or change setting press OK and a new setting can be selected or the selected is active.

The delay is specified by a number of whole number seconds from 0 to 30. The delay begins on the activation of the Ready for RAD Exposure input from the generator

a) Click to select Injection Delay time in seconds
b) Left click on injector icon.
c) The button will change to indicate function is active.
d) Click ▼ to select Injection Delay time in seconds.

CAUTION: Ensure and observe manually that injector is correctly armed and ready before and during the process.

NOTE: This feature is only available on DSA systems and must be enabled in the Service Application.

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6.2.4 Rotational Angiography (optional on DSA systems only)

Sequence set up is done in the control room: Injector Set up and Procedure Selection on the digital imaging system, then Image Distance and Frame Rate at rest on the generator touch screen.
Rotational Angiography is performed acquiring Mask images first, then contrast images.

When a contrast (bolus) image is made, the subtracted images are shown live on the monitor.

When a contrast image is made, the subtracted images are shown live on the monitor. The procedure is made uni-directional, i.e. both Mask and Contrast Images are made from one side (LAO or RAO).

CAUTION: Prior to performing the Rotational Angiography procedure, the operator must ensure:

a. The patient is supported for minimum movement during the procedure.
   The use of additional filters is highly recommended in order to improve fixation and image quality.
b. Diagnostic coverage and collision-free scan movement during procedure by performing pre-procedure positioner movements. Using Fluoro does this. The cross that shows on the center of the image on the monitor and/or the laser light cross (optional) on the Image Intensifier Touchguard
c. All positions are set as required during Rotational Angiography procedure. Once the positions are stored in the Memory buttons 1 and 2, all movements but C-arc rotation will be locked.

NOTE: A Rotational Angiography procedure can be aborted at any time:

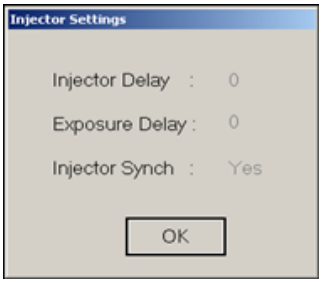
- During procedure setup:

  On the generator Touchscreen, press the

  button.

- During procedure run:
  Release the exposure switch and/or the Recall2 button. Releasing either of these will abort the procedure and the procedure cannot be resumed.

Set up and Rotational Angiography is performed as follows:

	1. Injector synchronization can be changed as described in Chapter 6.2.3 Default values are settings from last Rotational Angiography performed. When settings are adjusted, press OK and select procedure.

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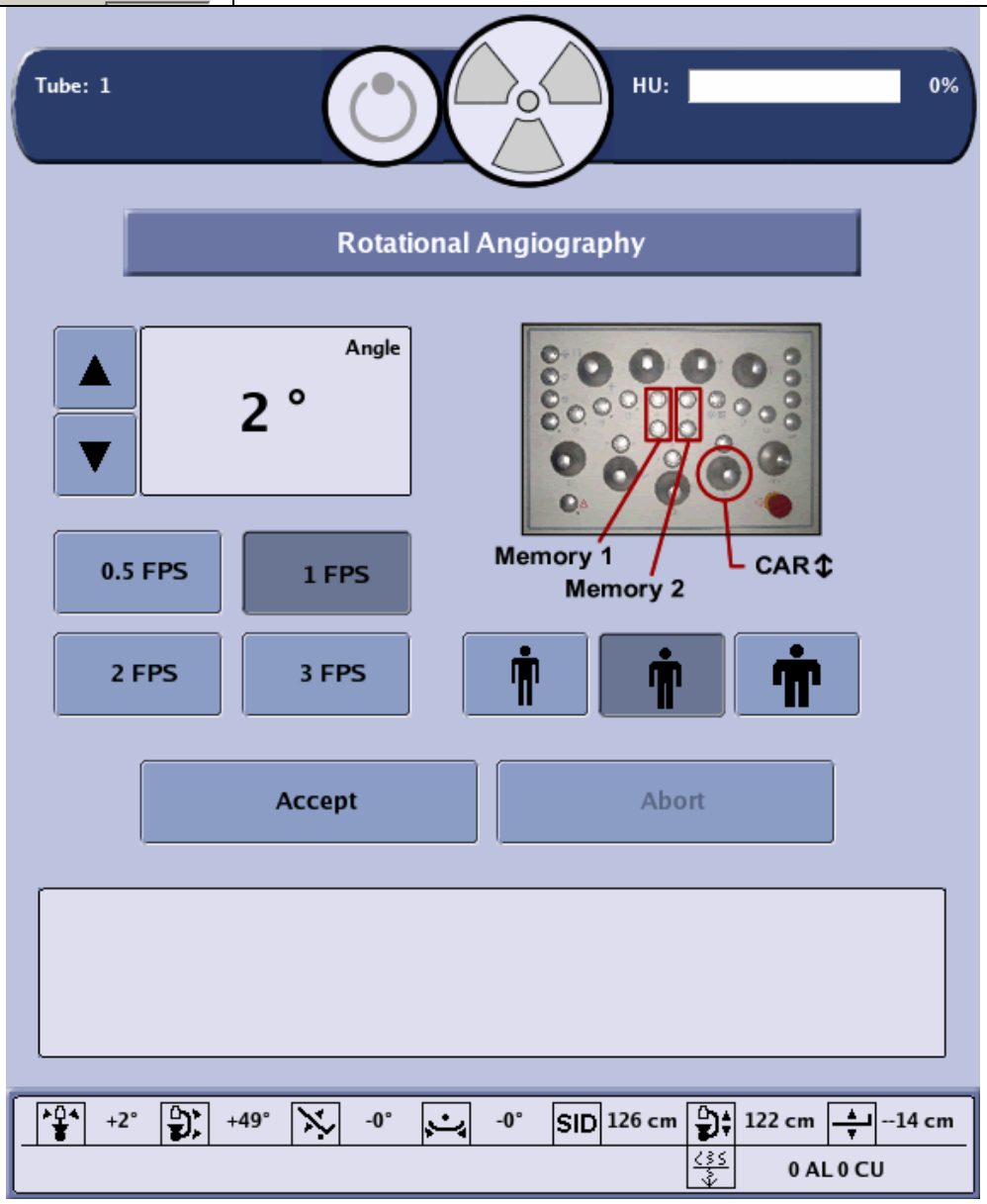
2. To activate **Rotational Angiography (RA)**, click on the Standard Control Box on the ***Main Image*** screen.

While this feature is activated, the text on the buttons will change to RA.



Generator Touchscreen: Rotational Angiography

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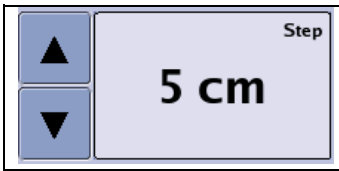
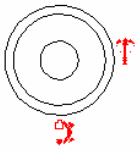
	3. Set Rotational Angle (angle between images in degrees): 2, 4, 6, 8, or 10°.
	4. Select Frame Rate at rest (before and after activating the joystick: 0.5, 1, 2 or 3 FPS
	5. Select patient size: Small, medium or large
	6. Press the Accept button when all settings are made and preparations of the positions can be made
MOVE TO END POS AND STORE IN 2 	7. Move the C-arc to the end position of the RA procedure by means of the CAR joystick and press Memory2 to store the position. The position is not stored until a beep is heard and a green light is led next to the button. **NOTE**: All other positioner movements are locked during RA-mode after having stored the positions in Memory 2. **NOTE**: It is recommended that a few extra degrees be added to the end position to allow for deceleration of the rotational movement.
MOVE TO STARTPOS AND STORE IN 1	8. Move the II to the start position and press Memory1 to store the position. The position is not stored until a beep is heard and a green light is lit next to the button. **NOTE**: It is recommended that a few extra degrees be added to the start position to allow for acceleration of the rotational movement.
MASK RUN PUSH RECALL2 AND EXP	9. Expose (by means of the foot switch or exposure button) to make the first Mask Exposure and press Recall2 until the end position is reached when a beep sounds. **WARNING:** Do not release the buttons until the beep is heard. Releasing the buttons will require the entire procedure to be repeated and thereby increasing the patient's radiation dose.
RELEASE RECALL2 AND EXP	10. Release both Exposure Switch and Recall button. **NOTE**: This message is only shown on the positioner monitor.
MOVE TO STARTPOS PUSH RECALL1	11. Return to start position pressing Recall1
PUSH RECALL2 AND EXPOSE	12. Activate the Exposure Button when Injector is ready to Start Injection and Frame Rate at rest. Press Recall2 to perform the rotation.
ROTATIONAL ANGIO RUNNING	13. Keep Recall2 pressed until a beep sounds.
ROTATIONAL ANGIO COMPLETED	14. When the beep sounds, the Rotational Angiography procedure is complete and Recall2 can be released. Frame Rate at rest can be viewed until release of the Exposure foot switch.

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6.2.5 Bolus Chase (optional on DSA systems only)

Sequence set up is done in the control room: Injector set up and Procedure selection on the digital imaging system, then Image Distance and Frame Rate at rest on the generator touch screen.

Bolus Chase is performed acquiring Mask images first, then Contrast (bolus) images. The procedure is made uni-directional, i.e. both Mask and Contrast (bolus) images are made from injection point downwards.
When a Contrast (bolus) image is made, the Subtracted images are shown live on the monitor.

CAUTION: Prior to performing the Bolus Chase procedure, the operator must ensure:

a. The patient is supported for minimum movement during the procedure.
   The use of wedge filters around and between the legs in order to improve fixation and image quality is highly recommended.
b. Diagnostic coverage and collision-free scan movement during procedure by performing pre-procedure positioner movements. Use Fluoro to do this and/or the laser light cross (optional) on the Image Intensifier Touchguard
c. All positions are set as required during Bolus Chase procedure. Once the positions are stored in the Memory buttons 1 and 2, only the MAC (scan) joystick can be activated. All other movements will be locked.

Note: A Bolus Chase procedure can be aborted at any time:

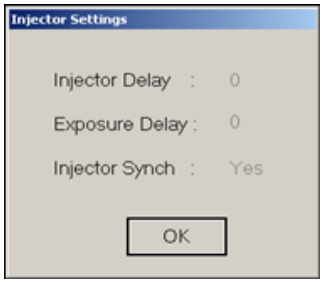
- During procedure setup:

  On the generator Touchscreen, press the

  button.

- During procedure run:
  Release the exposure switch and/or the Recall2 button. Releasing either of these will abort the procedure and the procedure cannot be resumed.

Set up and Bolus Chase run is performed as follows:

	1. Injector synchronization can be changed as described in Chapter 6.2.3 (Photospot Acquisition & Display). Default values are settings from last Bolus Chase performed. When settings are adjusted, press OK and select procedure.

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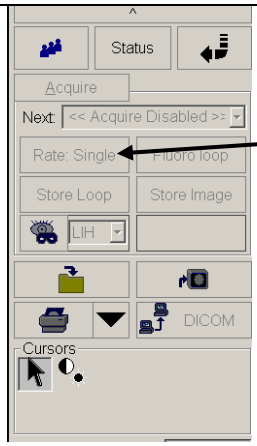
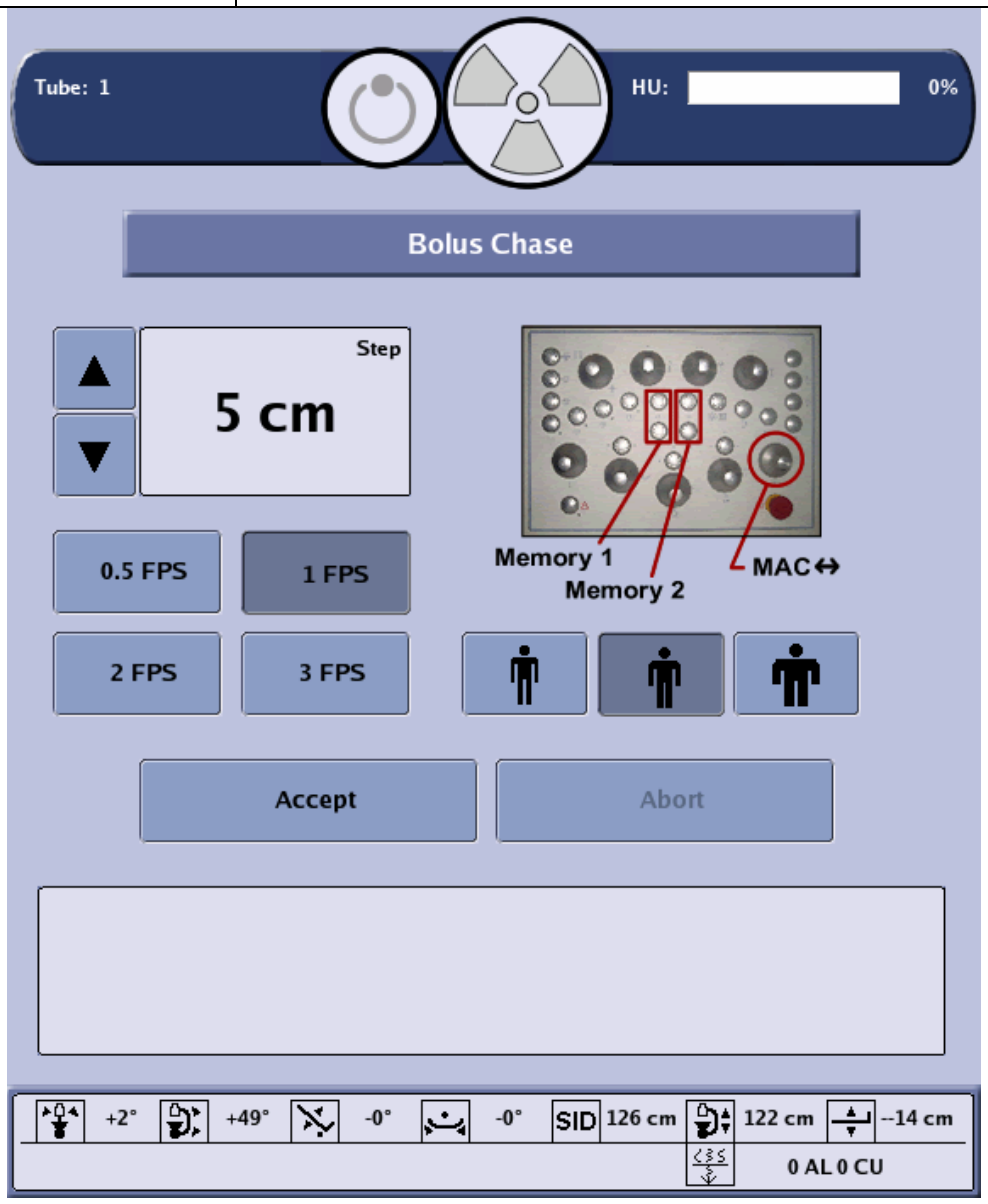


2. To activate **Bolus Chase (BC)**, click

on the Standard Control Box on the ***Main Image*** screen.

While this feature is activated, the text on the buttons will change to BC.



Generator Touchscreen – Bolus Chase

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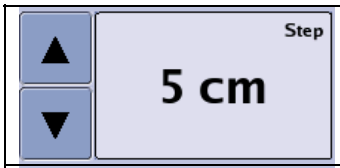
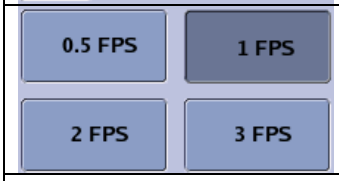
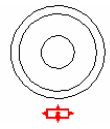
	3. Set Step Rate (distance between images): 5, 7, 10, 15, or 20 cm
	4. Select Frame Rate at rest (before and after activating the joystick: 0.5, 1, 2 or 3 FPS
	5. Select patient size small, medium or large
	6. Press the Accept button when all settings are made and preparations of the positions can be made
MOVE TO END POS AND STORE IN 2 	7. Move the II to the end position of the Bolus exposure (patient's feet) activating the joystick and press Memory2 to store the position. The position is not stored until a beep is heard and a green light is lit next to the button. **NOTE**: All other positioner movements are locked during BC-mode after having stored the positions in Memory2.
MOVE TO STARTPOS AND STORE IN 1	8. Move the II to the injection start position and press Memory1 to store the position. The position is not stored until a beep is heard and a green light is lit next to the button.
MASK RUN PUSH RECALL2 AND EXP	9. Expose (by means of the Foot Switch or Exposure Button) to make the first Mask Exposure and press Recall2 until the end position is reached when a beep sounds. **WARNING:** Do not release the buttons until the beep is heard. Releasing the buttons will require the entire procedure to be repeated and thereby increasing the patient's radiation dose.
RELEASE RECALL2 AND EXP	10. Release both Exposure Switch and Recall button. **NOTE**: This message is only shown on the positioner monitor.
MOVE TO STARTPOS PUSH RECALL1	11. Return to Injection Position by pressing Recall1. Position is reached when beep signals are heard.
BC READY PRESS GTO2 AND EXPOS.	12. Activate the Exposure Foot Switch when Injector is ready to Start Injection and Frame Rate at rest. 13. Press Recall2 and activate joystick when the dye is in the field of view to follow the dye.
BC RUN FOLLOW BOLUS WITH JOYSTK	14. Follow the dye until a beep sounds. If the dye does not move as quickly as anticipated the joystick can be released at any position during the chase allowing for exposures at the set frame at rest rate to

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	see the vascular flow. The joystick can be reactivated when the dye is in the field of view again. Note: This message is only shown on the positioner monitor.
BC COMPLETED REL. RECALL2 + EXP.	15. When the beep sounds, the Bolus Chase procedure is complete and Recall2 and joystick can be released. Frame Rate at rest can be viewed until release of the Exposure Foot switch.

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6.2.6 Edge Enhancement Feature

Use the Edge Enhancement feature to enhance an area with large differences in contrast. It increases the spatial resolution of an image display often increasing the visibility of image detail. There are five levels of Edge Enhancement (None, Level 1, 2, 3 or 4). Low-pass Edge Enhancement adds a finer level of detail. When the Low-pass filter is activated, it replaces one of the four levels normally available.

As images are acquired the system will apply the Edge Enhancement setting selected in the ***Doctor Preferences*** feature. To adjust the Edge Enhancement setting for the next acquired fluoro image without adjusting Doctor Preferences:

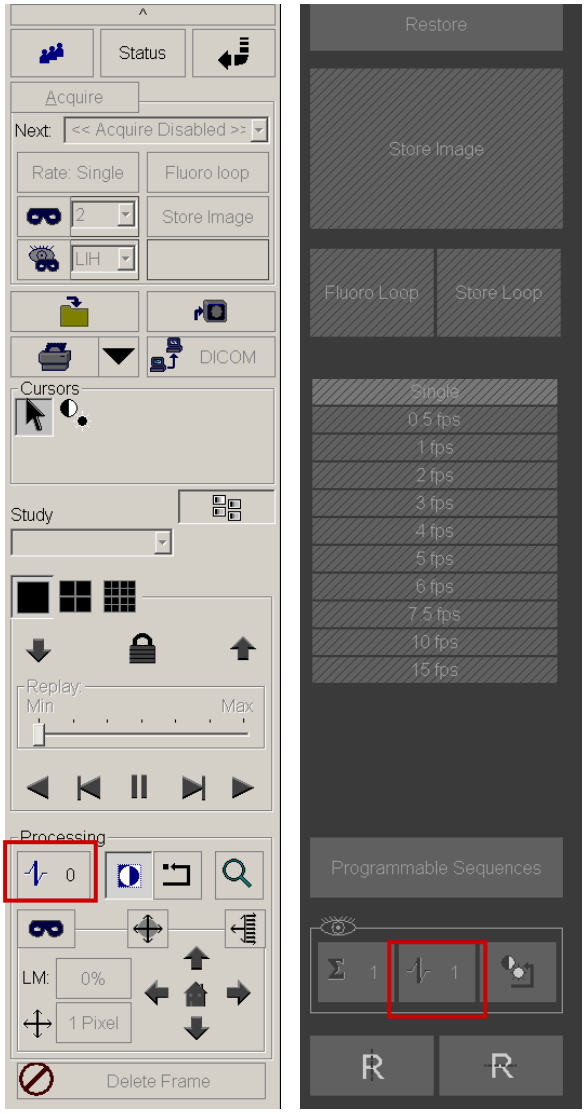
1. Hide the tool panel by clicking ^ at the top of the ***Standard Control*** box.
2. A "ghost" panel will replace the Control Area panels.
3. Click on the Edge Enhancement button that appears at the bottom of the hidden panel.

NOTE: The Edge Enhancement button is identical to the Edge Enhancement button on ***Expanded Control*** box and located at the lower processing panel.

4. Click to increase level to be applied to next acquired image.

Edge enhancement applied during Fluoro acquisition temporarily changes the default edge level set in Doctor Preferences. When that image is reviewed, the applied edge level will be carried over and the button on the processing screen will reflect that level. Changes to the image processing edge button will be carried with the reviewed image. Changes to the image processing edge level will NOT change the acquire edge levels.

In all other instances, the Edge Enhancement button on the image processing GUI will show the level set in Doctor Preferences.



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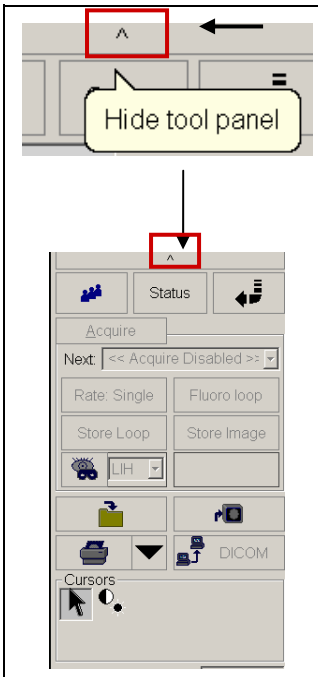
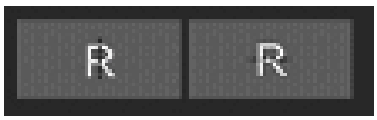
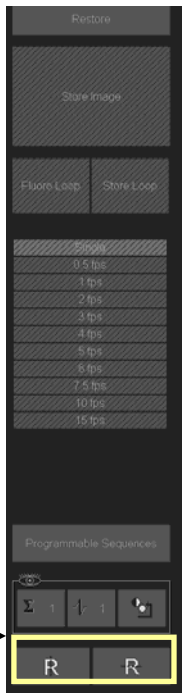
6.2.7 Horizontal & Vertical (H&V) Reverse

Use H/V Reverse for image reversal during live Fluoro.
H&V Reverse allows the acquired image to be reversed in the **Horizontal** direction, the **Vertical** direction or both directions as they are acquired.

<table>
<tr>
<td> 
</td>
<td>Hide Tool Panel – Located at the top of the Standard Control box, click Arrow (^) to eliminate the Tool Panel Display from the screen.
The “H/V Reverse” buttons on the GUI Shutter can be used to reverse Fluoro image orientation during live Fluoroscopy for the next image acquired.
 

or


GUI Shutter</td>
</tr>
<tr>
<td>Doctor Preferences</td>
<td>The Doctor Preferences interface for H&V Reverse allows the image orientation to be configured according to the normal work patterns of a particular doctor.

The orientation specified in the preferences may be overridden with the GUI shutter interface.</td>
</tr>
</table>

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6.2.8 Mag Modes

GE Precision MPi has four MAG or Field of View (FOV) setting, providing a close-up of anatomical regions.

INPUT / FIELD OF VIEW	APERTURE	TYPICAL USAGE and DOSE	TYPICAL DOSAGE
Normal (MAG 0)	12 inch	Wide open; Panning; Localization of area of interest	LEAST
MAG 1	9 inch	Typical studies run here to see smaller items close-up	MORE
MAG 2	6 inch	Even closer; can see intestinal polyps	MORE +
MAG 3	4.5 inch	Super close-up required of small area in adult; Smallest pathology; and pediatrics	MOST, but possible to reduce for child

MAG Modes Chart

The Precision MPi configuration has MAG FOV inputs to finely compensate for the available light due to the Generator, Auto Exposure Control, and Intensifier Response. Configuration can be done through the Service Application Configuration Screen.

Image Examples for different MAG Modes and Uses

NORMAL (12") Panning; Localization of image area and for Upper and Lower GIs

1 X-ray Run at 9" and study run at 6"; here at 9" MAG 1 AND MAG 2) Close-up images

(4.5") For smallest pathology; and pediatrics

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6.2.8.1 Mag Mode Diagram

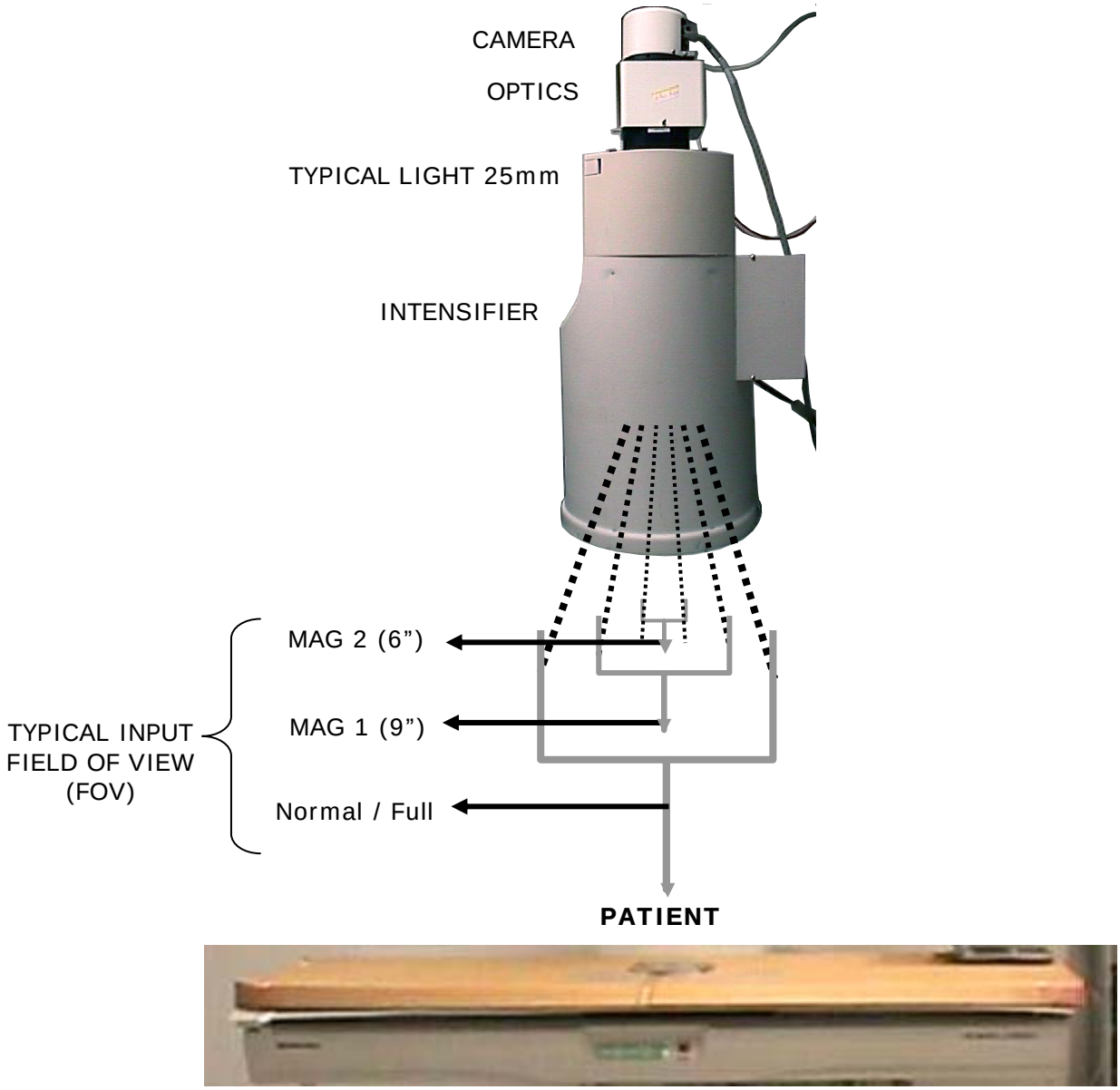

Table with X-Ray Tube Below

Configuration of MAG Modes can be done through the Precision MPi Service Application Configuration Screen.

NOTE: Additional information on this topic is beyond the scope of this manual. See your Service Applications Administrator.

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6.2.9 Fluoro Noise Reduction

Spatial Implemented when there is no Fluoro Edge Enhancement setting selected within Doctor Preferences.

Time domain The time domain Fluoro Noise Reduction setting is selected as a Doctor Preference.

Available settings	• None • Non-recursive • 2-frame Recursive • 4-frame Recursive • 8-frame Recursive • Recursive w/ Motion Correction Level 1 • Recursive w/ Motion Correction Level 2 • Recursive w/ Motion Correction Level 3 • Recursive w/ Motion Correction Level 4
Motion Detection & Correction	Motion detection measures the change in contrast from one frame to the next. Based on the amount of change in contrast, the amount of integration will decrease. Large change will decrease the amount of integration and vice versa.

6.2.10 Reference Image Display

Up to fourteen (14) images may be displayed and stored as Reference images in the Reference Thumbnail list.

Additional images may also be sent to the Reference Display from the Primary Display's Thumbnail window, but those images will then overwrite the oldest thumbnail position.

The Reference Image Thumbnails will operate in a queue fashion; the oldest Reference image will be replaced when queue is full.

Configuration can be done through the Service Application Configuration Screen.

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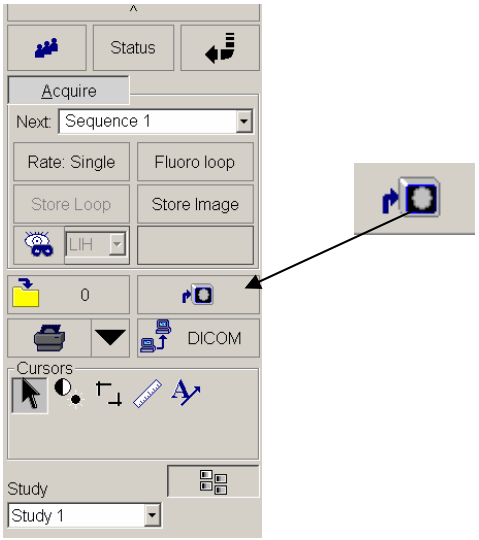
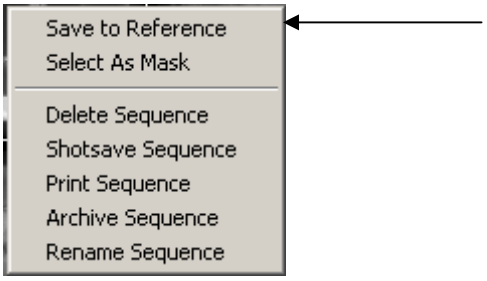
6.2.10.1 Save Image to Reference

Manual Save	To save an image displayed on the Primary Display to the Reference Image Display: • Use the "Create Reference Image" button in the Standard Control Box.  For Multi-image Display scenarios, the "Create Reference Image" button operates on the image currently highlighted with the Image Selector Box. • An image that is already stored to the local database may be moved to the Reference Image Display by right clicking on the thumbnail and selecting "Save to Reference".  • Alternately, use the **F9** key to save the current image to Reference Display. **NOTE:** Save to Reference will send the image represented by the thumbnail to the Reference Image Display.
Auto LIH to Reference	The Auto LIH to Reference feature will automatically transfer each LIH image to the Reference Display when the next acquisition begins. This feature must be configured in Doctor Preferences.

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6.2.11 Acquisition Last Image Hold (LIH)

Last Image Hold (LIH) allows the last image displayed on the image screen to be saved or stored to the local database.

NOTE: Any time that fluoro radiation is active and system is set to acquire, live fluoro is displayed.
The last displayed image will become the new LIH image when fluoro radiation is terminated.

6.2.11.1 Store Fluoro LIH to Local Database

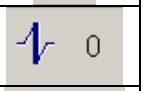
This feature provides the capability to selectively store LIH images to the system's database. A thumbnail will be created for each image stored.

1. Click the **Store Image** button in the Standard Control Box.
2. The LIH image is transferred to the local database.
3. A thumbnail for this image is added to the end of the list for the current study.

Fluoro images can be automatically stored by enabling the Auto Save LIH to disk option in Fluoro Doctor Preferences dialog box.

6.2.11.2 LIH Features

The following features can be applied to the Last Image Hold image:

Adjust Image Contrast (Window)	Drag Brightness/Contrast cursor horizontally to adjust Contrast	
Adjust Image Brightness (Level)	Drag Brightness/Contrast cursor vertically to adjust Brightness	
Invert the Gray Scale (Invert)	Use Invert button on Expanded Control Menu	
Fluoro LIH Edge Enhancement	Use Edge Enhancement button	
Reference Image Display	Use the Save to Reference Image button on the Standard Control box.	
Zoom	Single click the Zoon icon to enlarge the image. To disable Zoom function, single click Zoom icon.	

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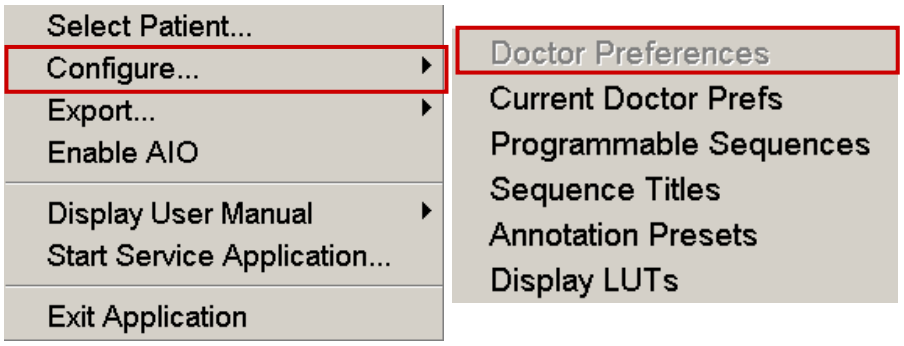
6.3 Auto Acquisition Replay

This feature is set on the Doctor Preferences – **General Acquisition** menu. Acquired sequences will automatically replay on the Control Room Monitor at the acquisition rate.

To temporarily change the default behaviour:

1. Right-click in the Image Area. A Sub-menu will appear.
2. Position the cursor on **Configure**, and then click on **Current Doctor Prefs.**
3. Make selections from Doctor Preferences' setup screen.
4. This function allows the temporary modification of any of the Doctor Preferences fields for the current patient/doctor.



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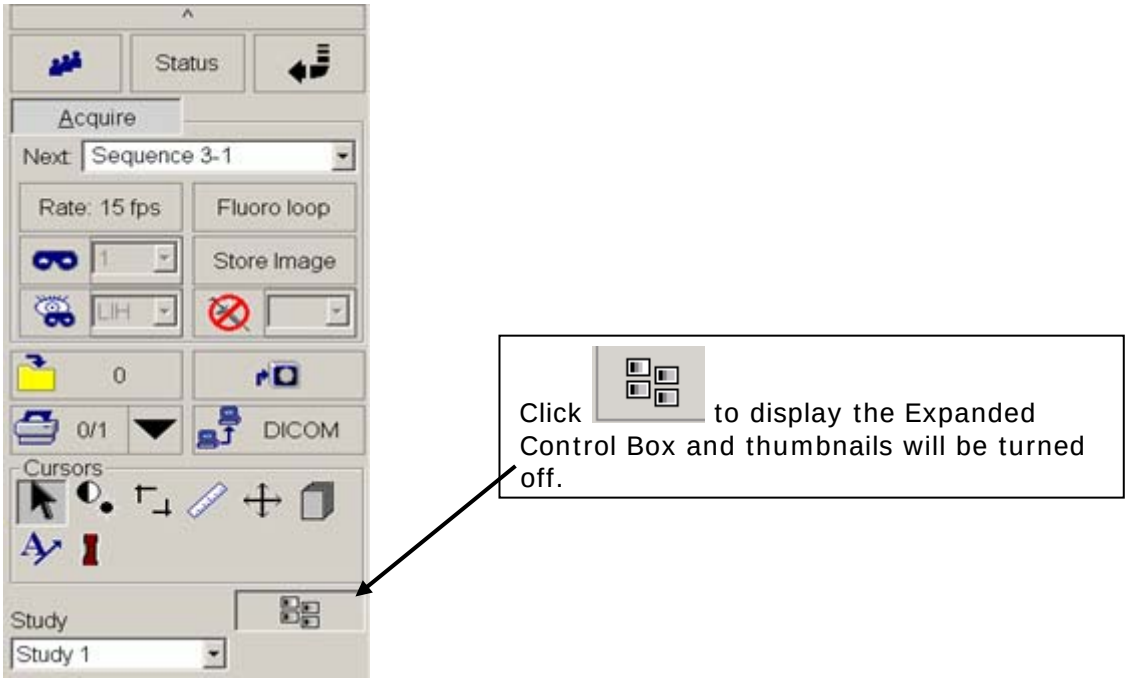
7.1 SEQUENCE SELECTION

After patient images have been acquired, the images can be reviewed and image Processing may be applied. Processing features selected can only apply to the image currently display in the Main Image screen. Applied processing features can be saved to the database after the patient is closed. When images are sent to a DICOM Printer Device, the processing features will also be applied to the image.

7.1.1 Displaying Expanded Control Box

Prior to the application of processing features, an image must be selected. Image processing feature buttons are located on the ***Expanded Control Box.***



- The ***Expanded Control Box*** will display directly underneath the ***Standard Control*** box and covering the area where the thumbnails appear.
- To restore **Thumbnails** to the screen, click on .

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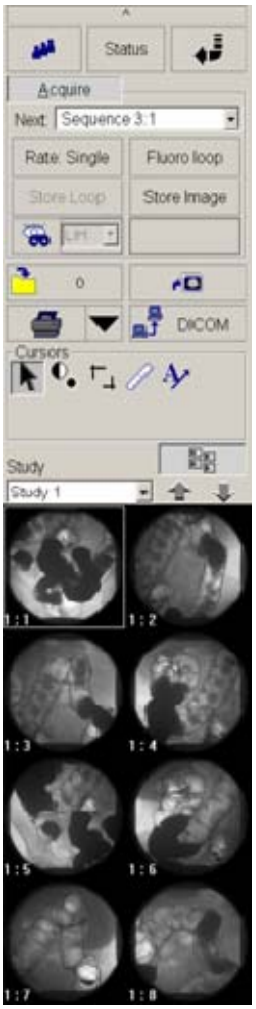
7.1.2 Thumbnail Display

The Control Room Display monitor contains thumbnails whenever a patient file is open for **Review** or **Acquire**. A thumbnail image for each sequence in a study is displayed on the left-hand side of the Control Monitor as shown in the figure that follows.



To show more thumbnails, click on the ***Standard Control box*.**

7.1.3 Select an Image

To select an image or sequence from the Thumbnails Left-click on a thumbnail with the mouse or in-room pointing device and the image will display in the Image Display Area.

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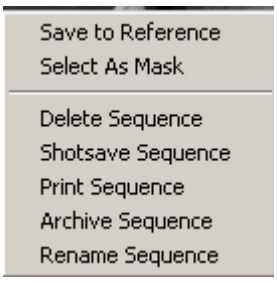
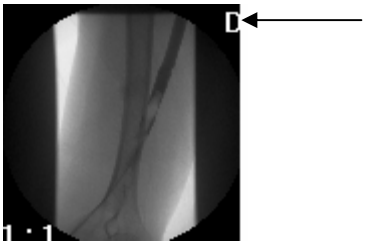
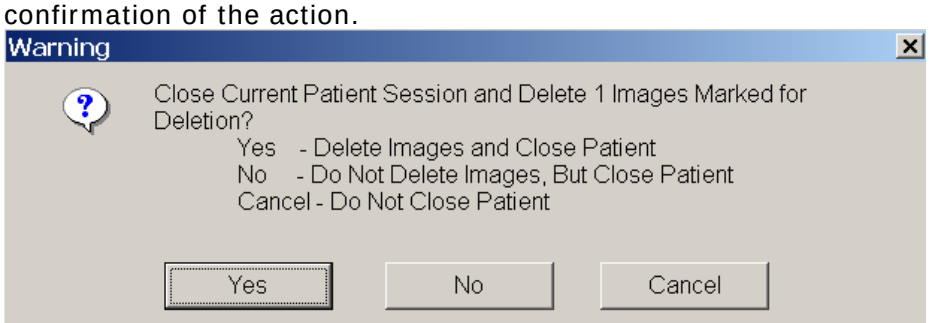
7.1.4 Thumbnail Right-click Menu

Any time that thumbnails are displayed on the ***Main Image*** screen, a series of related functions can be accessed through the ***Thumbnail Righ-click Menu***. Move the cursor over the thumbnail desired and right-click.



Select	Functions
Save to Reference	Saves Thumbnail Image to reference monitor.
Select As Mask	Select Thumbnail Image as mask.
Delete Sequence	Deletes selected sequence. All images in this sequence are marked with a “D”. The thumbnail is also marked with a “D”.  The sequence will be deleted when the patient file is closed. Prior to the sequence being deleted, a warning box will appear asking for confirmation of the action.  Make applicable selection from warning window and proceed.
Shotsave Sequence	Click to **Shotsave** the entire sequence into **ShotSave** folder as a single thumbnail.

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Print Sequence	Click to print sequence. See Chapter 8 – Printing, Archiving and Retrieving images.
Archive Sequence	Click to archive sequence. See Chapter 8.11.5 – Exporting from Thumbnail.
Rename Sequence	Click to rename sequence. See Chapter 7.14.3 – Sequence Title Edit.

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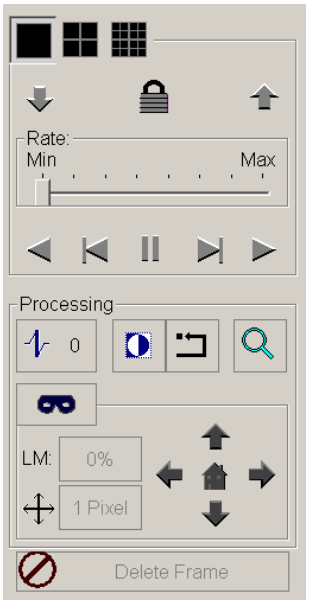
7.2 SEQUENCE REPLAY

- The image processing settings for replaying sequences are selected based on the configuration of the **Doctor Preferences.**
- **Doctor Preferences** can be set to either the acquisition settings or the last viewed settings.
- For DSA and Roadmap sequences, the image processing settings include subtraction and mask frame.

7.2.1 Using the Control Room Mouse



The ***Expanded Control Box*** contains controls for selecting Sequence Replay features including

Loop Lock Lock – Locks replay within a sequence or with a study.

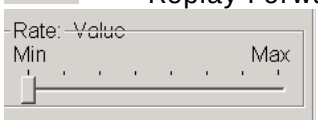
Replay Reverse,

One Frame Reverse

Replay Pause,

One Frame Forward

Replay Forward,



Replay Rate (Fluoro 3.75, 15, 30)
(Acquisition 0.5, 1, 2, 3, 4, 5, 6)

Slider control accesses Replay Rate.

Click appropriate arrows to accomplish sequence replay as needed.

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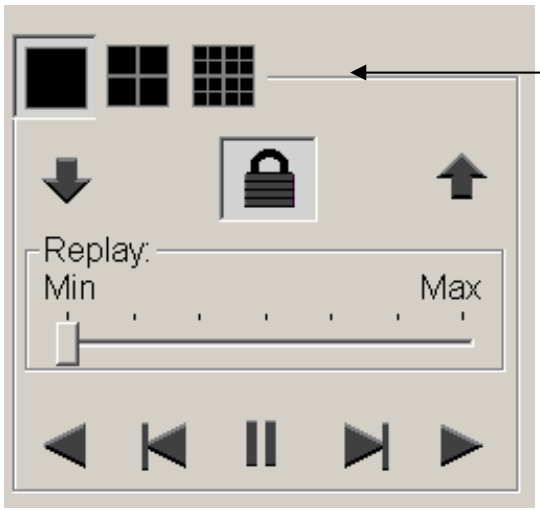
7.3 DISPLAY FORMAT

The display format discussed in this section only applies to the screen of the Primary Display monitor. The available display formats are:

- 1-on-1
- 4-on-1
- 16-on-1

The default display format is 1-on-1. Each time a new exam is opened, this will be the display format used.

Display formats are selected from the ***Display Format*** box located in the ***Expanded Control Box*** (Lower Processing Panel)**.**



	Set Full Screen Display For 1-on-1
	Set 2X2 Multiple Image display for 4-on-1
	Set 4X4 Multiple Image display for 16-on-1

- Click on any image frame in Multiple image display mode to select it. It will then be highlighted.
- Double-click on any frame in the Multiple image display mode to display it in the 1-on-1-display format.

NOTE: The following functions can only be applied in 4-on-1 or 16-on-1 display format.

- Expose to hardcopy
- Drag to Stacking window
- Delete Frame
- Mark for Shotsave™
- Save to Reference
- Loop Lock

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7.3.1 Changing sequence

To move to the next sequence in the patient file, left-click . This button will allow single clicks even if held down.

To move to the previous sequence, left-click . This button will allow single clicks even if held down.

This function works in all three display modes.

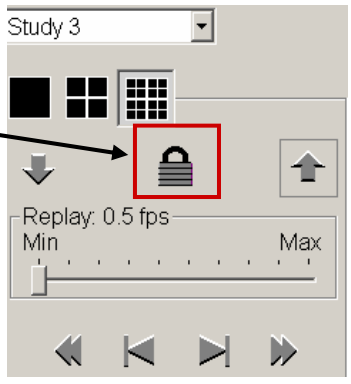
- If there are less than sixteen (16) images, all of the images will appear in the display area at the same time. Clicking on the arrow will bring up the first image in the next sequence.
- If there are more than sixteen (16) images in the 16:1 mode, clicking on the arrow will bring up another page of images if the next sequence is not displayed on the current page.

7.3.2 Loop Lock

Click to turn On the Loop Lock feature.

When Enabled, Loop Lock will allow the display of only the selected Sequence.

When Disabled, it will allow the display of as many Sequences as will fit the MID selection.



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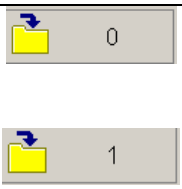
7.4 SHOTSAVE™

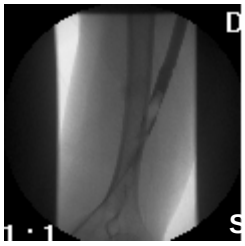
During image review, the current image can be saved to a separate file called a **ShotSave™** file. Images can be marked as **ShotSave™** images in order to create a sub-set of images within a patient file for convenient review, printing or transfer.

ShotSave™ images remain as part of the patient file and are not deleted or moved from their original storage spot within the file.

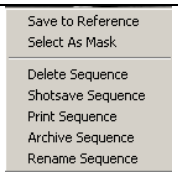
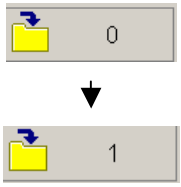
ShotSave™ images maintain any processing settings applied. Images can be marked for **ShotSave**™ in one of three ways.

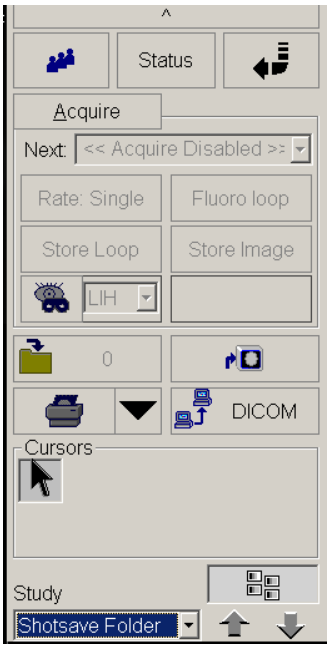
Using ShotSave™ Button:

1. Click on the ***ShotSav***" button.	
2. The current on-screen image will be saved to the **ShotSave™** folder.	
3. The number on the Shotsave Folder button will increase to reflect the addition of the new image. The particular frame will be marked with an "**S**" in the lower right corner of the image on the main image screen.	



From Thumbnails:

1. Right click on the desired Thumbnail. The ***Thumbnail Right Click Menu*** displays.	
2. Select **Shotsave Sequence.**	
3. The selected sequence will be saved to the Shotsave folder and the number on the Shotsave Folder button will increase to reflect the addition of the new sequence. The image representing the sequence will be marked with an "**S**" in the lower right corner of the thumbnail and all frames in the sequence will be marked with an "**S**" in the lower right corner of the image on the main image screen.	



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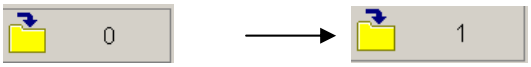
Using ShotSave™ cursor

When a sequence is opened for Review in 4-on.1 or 16-on-1, the **ShotSave™** cursor will appear in the ***Cursor Tool*** bar.

1. Single click on the cursor. Cursor becomes "Active"
2. Move ShotSave™ cursor over image to be saved to the Shotsave™ folder and double click.
3. The image will be saved to the Shotsave™ folder and the number on the Shotsave Folder button will increase to reflect the addition of the new image.



The image will be marked with an "**S**" in the lower left corner of the image on the main image screen while in the MID mode.

To view the Shotsave folder, click down arrow under <Study> and left-click on **ShotSave Folder.**

NOTES:

- ShotSave™ images are stored into a special ShotSave™ study (folder).
- Acquisition will be disabled while the ShotSave™ study is open.
- ShotSave™ images can also be deleted after they have been saved.
- See Chapter 7.6 on 'Mark Image for delete'

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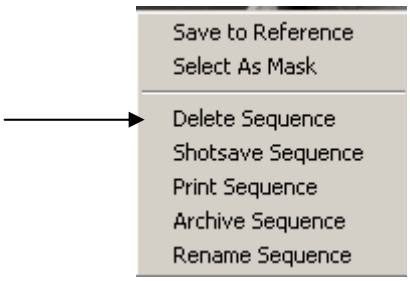
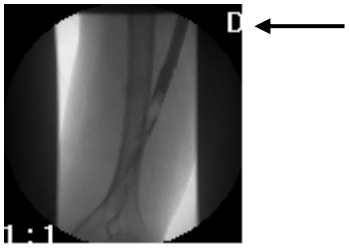
7.5 MARK SEQUENCE FOR DELETE

This feature allows an entire sequence to be marked for deletion. In order to delete a sequence, the pointer cursor must be active and the sequence thumbnails displayed.

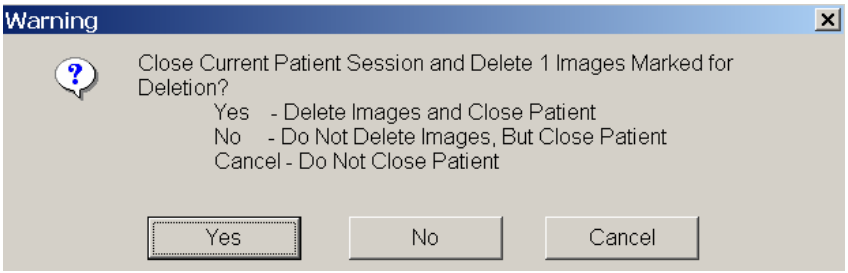
1. Place the cursor over a thumbnail and right-click.
2. The ***Right-click*** menu will display



3. Select "Delete Sequence"
4. A Delete icon will appear as a "D" in the upper right corner of the thumbnail as well as in the lower left corner of the image in the main image display area.



5. When the patient file is closed, a warning window will display asking for confirmation of the delete sequence operation


Warning
Close Current Patient Session and Delete 1 Images Marked for Deletion?
Yes - Delete Images and Close Patient
No - Do Not Delete Images, But Close Patient
Cancel - Do Not Close Patient
Yes
No
Cancel

6. Read the descriptions for each button and then make a selection.

WARNING: This is the only confirmation that is displayed for deleting images. Once images have been deleted by selecting the Yes button in the Warning screen, images can no longer be retrieved.

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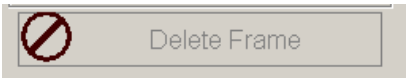
7.6 MARK IMAGE FOR DELETE

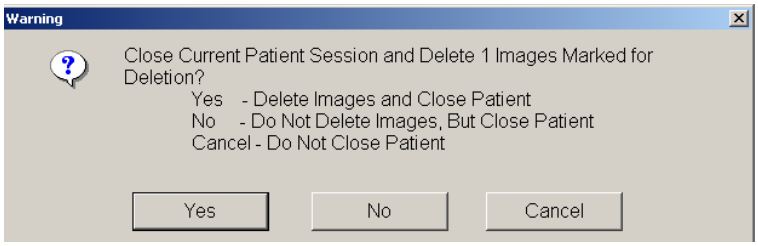
This feature allows an individual image to be marked for deletion. In order to delete an image, the pointer cursor must be active.

Single Image Display



1. Image is displayed in ***Main Image*** screen
2. Click on Delete Frame button on ***Expanded Control Box***.
3. A "**D**" will appear in the bottom right portion of the screen (above Window & Level settings)

4. When the patient file is closed, a warning will display asking for confirmation of deletion.


Warning
Close Current Patient Session and Delete 1 Images Marked for Deletion?
Yes - Delete Images and Close Patient
No - Do Not Delete Images, But Close Patient
Cancel - Do Not Close Patient
Yes
No
Cancel

5. Read the descriptions for each button and then make selection.
6. Image will be deleted when patient file is closed.

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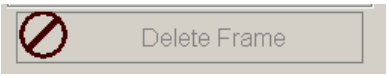
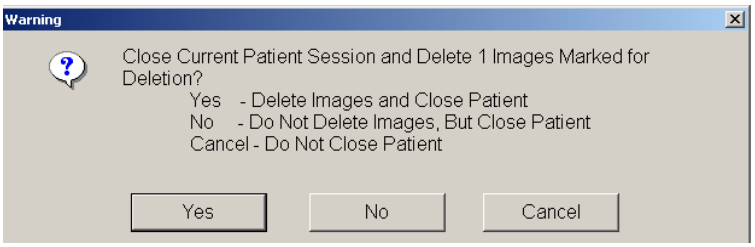
Multiple Image Display

<table>
<tr>
<td> 
</td>
<td>1. Images are displayed in the Main Image screen
2. Left click cursor when over the image to be deleted. A box will highlight the image.
Click on Delete Frame button on Expanded Control Box.
3. When the patient file is closed, a warning will display asking for confirmation of deletion.
 

4. Read the descriptions for each button and then make selection.
5. Image will be deleted when patient file is closed.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</table>

WARNING: Once images have been deleted by selecting the Yes button in the Warning screen, image can no longer be retrieved.

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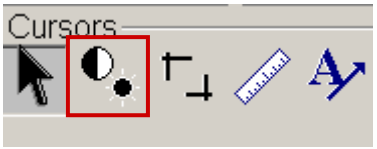
7.7 ADJUST IMAGE BRIGHTNESS/CONTRAST

Brightness/Contrast Cursor

BRIGHTNESS (LEVEL)

VERTICAL (Up/Down) MOUSE MOVEMENT

To adjust the Brightness (Level) of the image:



1. Select the Brightness/Contrast cursor from the Cursor Tool bar.
2. Position the Cursor in the Image Display Area.
3. Click and hold the left mouse button and drag the Cursor RIGHT to increase Brightness; LEFT to decrease Brightness.

NOTE: To increment or decrement by Brightness or Contrast alone, hold the keyboard ⇧SHIFT key down while moving Cursor Right and Left. This will deny movement of the Mouse Up and Down. The CONTROL (Ctrl) key can also restrict movement of the Mouse Up and Down. The object is to change one element at a time.

Brightness/Contrast Cursor

CONTRAST (WINDOW)

HORIZONTAL (Left/Right) MOUSE MOVEMENT

To adjust the Contrast (Window) of the image:

1. Select the Brightness/Contrast Cursor from the Cursor Tool bar.
2. Position the Cursor in the Image Display Area.
3. Click and hold the left Mouse button and drag the Cursor UP to increase Brightness; DOWN to decrease Brightness.

NOTE: To increment or decrement by Brightness or Contrast alone, hold the keyboard ⇧SHIFT key down while moving Cursor Up and Down. This will deny movement of the Mouse Left and Right. The keyboard CONTROL (Ctrl) key can also restrict movement of the Mouse Left and Right. The object is to change one element at a time.

NOTE: Typically, in a Windows® environment, when holding the **"SHIFT"** or **"CTRL"** key down while drawing a line either left and right or up and down, the cursor will stay on a perpendicular setting.

1. The ⇧**SHIFT** key will draw a line from point A to point B.
2. The **CTRL** key will start its point A at a center point and draw equilaterally outwards
having a point B and C, with both points being equidistant from its center-point A.

1.) A ——→ B

2.) B ←—A—→ C

NOTE: The Brightness/Contrast adjustment applies to all frames in the Sequence.
If a Sequence is replaying, the Brightness/Contrast Cursor is not available.

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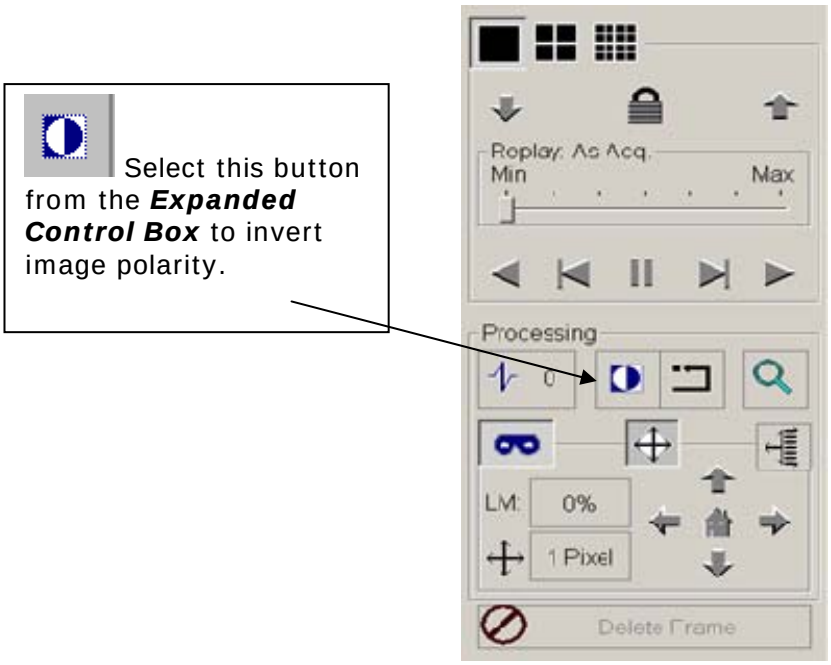
7.8 INVERT IMAGE POLARITY

The **Invert** Button changes the polarity of an image from a black (positive) contrast image to a white (negative) contrast image or from negative to positive.



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7.9 EDGE ENHANCEMENT

Edge Enhancement is a digital image-processing filter that is used to make pictures look sharper than they really are. An outline is added to foreground objects so that they stand out from the background. Details are more defined and can be more easily evaluated.
The DIS offers five levels of Edge Enhancement.

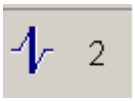
- Off
- Level 1
- Level 2
- Level 3
- Level 4

Edge Enhancement Button

Select the appropriate button from ***Standard Control box*** for required level of Edge Enhancement.

To change the Edge setting:

1. Select the button multiple times to cycle through the available settings.
2. The image display will be changed instantly as the edge setting is changed
3. A number on the Edge Enhancement button will indicate the level of Edge Enhancement applied.



Example showing level 2 of Edge Enhancement has been applied.

NOTE: Edge enhancement will only be applied to the sequence currently being viewed.

The Fluoro Edge Setting can be changed when doing Live Fluoro.
Edge enhancement applied during Fluoro acquisition temporarily changes the default edge level set in Doctor Preferences. When this image is reviewed, the applied edge level will be carried over and the button on the processing screen will reflect that level. Changes to the image processing edge button will be carried with the reviewed image. Changes to the image processing edge level will NOT change the default acquire edge levels.

In all other instances, the Edge Enhancement button on the image review and processing GUI will show the level set in Doctor Preferences.

NOTE: The edge setting will default to the acquisition setting the first time the sequence is viewed after acquisition unless that sequence being displayed is a ShotSave sequence. ShotSave sequences will be default to the edge setting that was active when the ShotSave was created.

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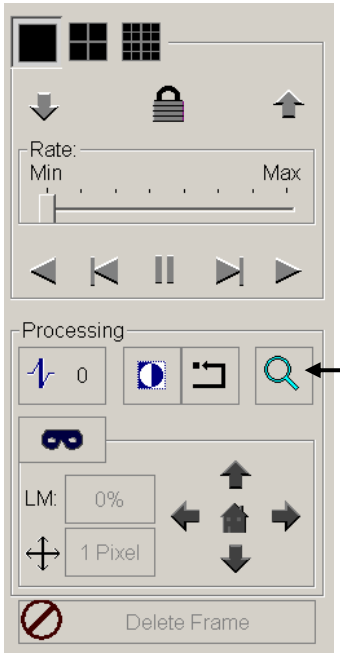
7.10ZOOM

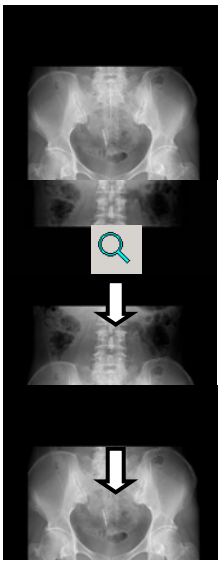
The ZOOM feature allows magnification of the currently displayed image to twice its size. The center of the image is shown on the monitor screen. Entering Zoom mode automatically activates the pan function.



Single click from the Expanded Control box to enlarge the image. To disable Zoom function, single click Zoom icon.

Panning

Select the Zoom icon, and then placing the Cursor on the image allows the Pan function. When viewing an image close-up, you will only be able to review a portion of the image, much like viewing a sample plate under a microscope. It has to be slid into a viewable area, but only so much space is available.



The Pan function will allow the entire image to be viewed in parts by sliding, or Panning the image into the viewable area. While Zoom and Pan is activated, it may be necessary to view a part of the image that is not shown on the screen (as in the case of using Shutters to hide portions of an image).

1. Position the Cursor on the image.
2. Click and hold the left mouse button.
3. Drag the Cursor in the direction you want to move.

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7.11 ELECTRONIC SHUTTERS

Each of the four sides of the black area surrounding the image is considered a *shutter*, and may be extended to match the exact image area to better view the image.

Shutter settings are applied to the image displayed in the screen as well as hardcopies of the images. These shutters may be adjusted manually for each image or automatically.

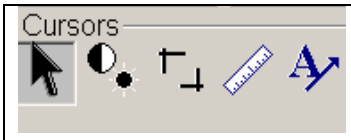
7.11.1 Automatic Positioning of Electronic Shutters

Each image that is reviewed will be analyzed to determine the position of the collimator blades. This information will be saved with the image data for use during replay. The Auto Digital Shutter feature must be enabled in Doctor Preferences in order for them to be applied during acquisition.

As images are reviewed when the Auto Digital Shutter feature is active, the system looks for the image boundary and extends the shutters to a few pixels beyond that point depending on the Shutter setting (low, medium, or high).

During image review, if manual shutters were applied to the image previously, the system will show the manual shutter settings instead of the automated shutters.

- During replay of a sequence, the position of the electronic shutters can be adjusted manually to compensate for errors with the automatic detection.
- Any adjustment will apply to all frames within that sequence.
- Each side of the black mask that surrounds the image can be adjusted separately.



1. Select the **Shutters** cursor from the ***Cursor*** tool bar.
2. Place the cursor on one of the four edges (top, bottom, left, right), hold down the left-click button and drag the shutter horizontally/vertically (as applicable) to the desired position.
3. Each of the four edges can be adjusted individually or the cursor can be placed in a corner where two edges meet. The two edges can be adjusted simultaneously.

NOTE: If Auto Shutters is **Off** in Doctor Preferences and during acquisition, clicking the shutters cursor will automatically apply shutter settings, if applicable, to the on-screen image and all images that are in the sequence.

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7.12 REFERENCE IMAGE DISPLAY

The Reference Image Display option allows any image being displayed on the Primary Image Monitor to be displayed on a second monitor. There are two available Reference Image Display options:

- Single Image Display with Thumbnail selection
- Multi-format Display

7.12.1 Single Image Display w/ Thumbnails

Up to fourteen images may be stored as Reference images in the Thumbnail list. Additional stored images may be sent to the Reference display, but those images will overwrite the previous thumbnails starting with the oldest.

The **Reference Image Thumbnails** operate in a queue fashion; the oldest marked image will be replaced as needed.

7.12.2 Multi-format Display

The Multi-format Reference Display supports the following formats:

- 1 – on – 1 Display
- 2 – on – 1 Display with Horizontal Tiles
- 2 – on – 1 Display with Vertical Tiles
- 4 – on – 1 Display

There will be no storage beyond the number of images displayed on the screen. Additional stored images may be sent to the reference display from the Primary Display's Thumbnail window. The Reference Image tiles will operate in a queue fashion; the oldest saved image sent to reference will be replaced as needed.

The following additional operations are also available for the Reference Display Option:

- Save Image to Reference via GUI
- Save Image to Reference from Thumbnail

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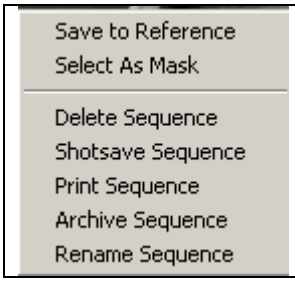
7.12.3 Save Image to Reference

Any image displayed on the Primary Display may be saved to the Reference Image Display. The images sent to reference are not required to be stored to the disk.

From the Standard Control Box

Save Reference Button	1. Click the **Save Reference** button in the ***Standard Control*** box. 2. The current image is sent to the Reference Monitor and is added to the Reference Thumbnail list.

From the thumbnail Right Click Menu

	1. Move the cursor over the thumbnail representing the sequence to be saved to reference and right click 2. Click the **Save to Reference** button. 3. The current image is saved to the reference monitor

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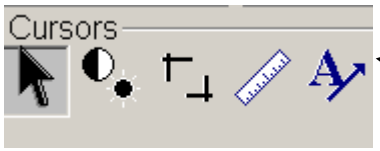
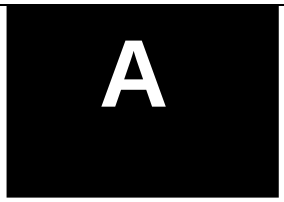
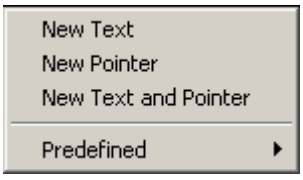
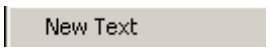
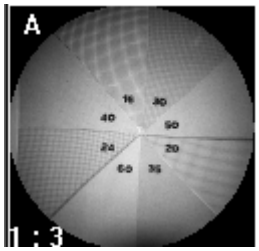
7.13 ANNOTATIONS

Select the Annotation button to choose from several options available for marking images. Customize Annotations according to individual requirements or select from a list of preset Annotations available.

From the cursor control bar:

	1. Select the **Annotation** cursor from the ***Cursor Tool*** bar to enter **Annotation** mode.
	2. Move cursor into the ***Main Image*** area. 3. Cursor will become an "A" indicating the **Annotations** feature has been activated.
	4. Double click within ***Main Image*** area to display the **Annotations** sub-menu. 5. Make selection according to specific needs.

7.13.1 New Text Annotation

 	1. Click to create a new text Annotation. 2. The <NEW ANNOTATION> text entry box will display. 3. The default text is highlighted. Type new text. 4. When entry is complete, click outside the text box (or press the Enter key) and the new Annotation will appear on the ***Main Image*** screen The thumbnail representing that image will be marked with an "A" in the upper left corner.

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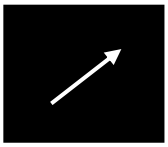
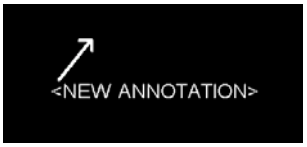
7.13.2 New Pointer Annotation

New Pointer	1. Click to add a Pointer (or arrow). 2. An arrow will appear within the ***Main Image*** screen. 

7.13.3 New Text and Pointer Annotations

The **New Text and Pointer** feature allows for the combination of these separate features into one interactive Annotation.

New Text and Pointer	1. Click to add a Text and Pointer Annotation 2. Both text and an arrow will appear within the ***Main Image*** screen. Type new text. 3. Click outside the area of the Annotation (or press enter) to save Annotation. 4. See Chapters 7.13.5 and 7.13.6 for instructions on changing or moving the Pointer or Text Annotation. 

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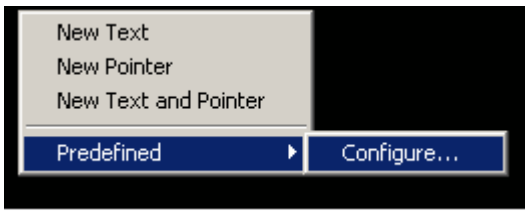
7.13.4Predefined Annotations

The DIS offers the option of entering and re-using a set of commonly used Annotations. This saves the time of creating individual Annotations for marking Left, Right, technician's initials, etc. Each time an Annotation is created, it becomes Predefined for that application.

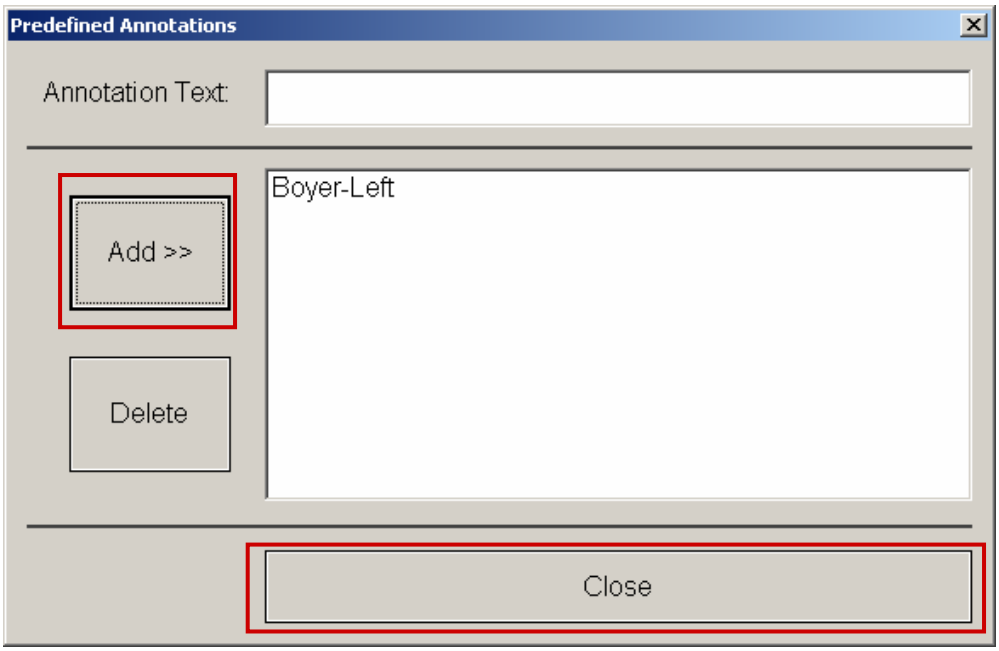
There are two ways to enter Predefined Annotations – Using the **Annotation Cursor** or the ***Right-click*** menu.

7.13.4.1 Using Annotation Sub-Menu

1. Select the **Annotation cursor** from the **Cursor Tool** bar to enter *Annotation* mode.
2. Move cursor into the Main Image area.
3. Cursor will become an "A" indicating ***Annotations*** has been activated
4. Double click within Main Image area to display the ***Annotations*** sub-menu.



5. Click on **Predefined** from **Annotations** sub-menu.
6. Click on **Configure** to display the Annotation Name screen.



Annotation Name Screen

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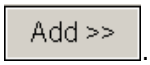
7. Type in the preferred text. This text will also be used to form the list of predefined Annotations.

8. Click. 

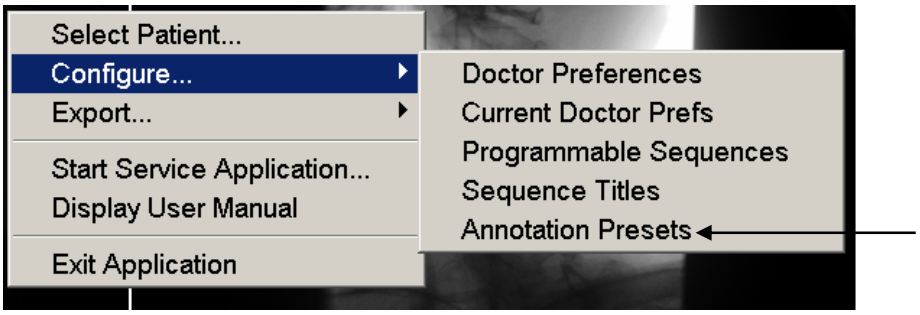
.

9. When adding Annotations is complete, select the Close button to save the list. Selecting the 'X' in the upper right corner of the window will cancel/erase any Annotation changes made in the previous steps.

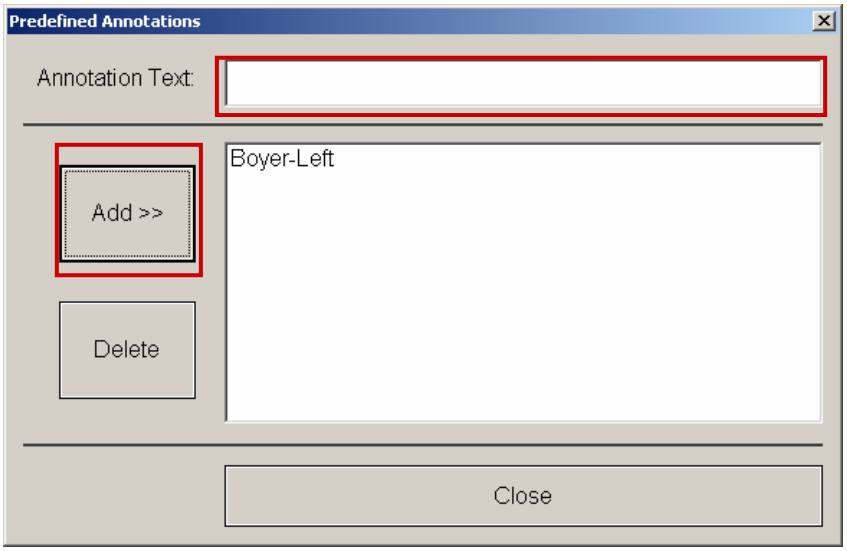
7.13.4.2 Using Right-click Menu

Predefined Annotations can also be created from the ***Right-click*** menu accessible from the ***Main Image*** screen.

1. Right click within ***Main Image*** screen to display sub-menu.
2. Place cursor over Configure. The ***Right-click*** sub-menu will appear.
3. Click on **Annotation** Presets



4. The **Annotation** Name screen will display



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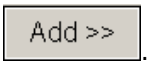
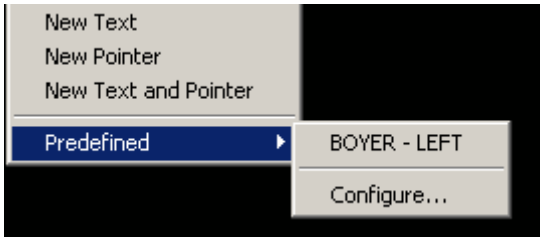
5. Type in the desired text. This text will also be used to form the list of **Predefined Annotations**.
6. Click. 

.
7. When adding Annotations is complete, select the Close button to save the list of predefined annotations. Selecting the "X" in the upper corner will erase any Annotation changes made in the previous steps.

7.13.4.3 Using Predefined Annotations

When an **Annotation** has been added to the list of those predefined, it can be selected for the current image as follows:

1. From Annotation submenu, select Predefined.
2. The list will appear.



3. Highlight Annotation to be added and left click.

The selected Annotation will be added to the Main Image screen and saved with the image data.

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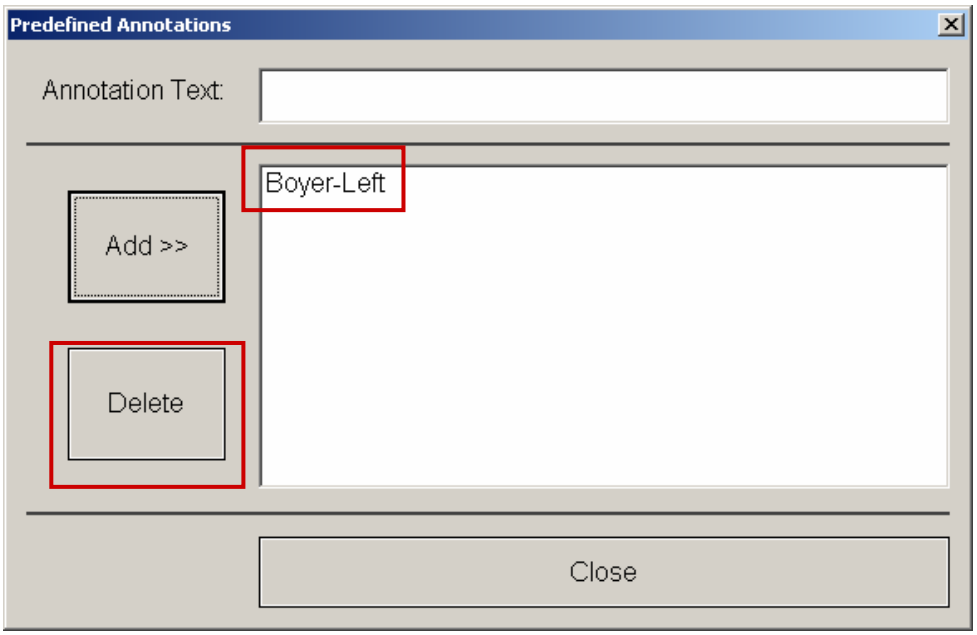
7.13.4.4 Delete Predefined Annotation

To delete an item:

1. From the list of Predefined Annotations on the **Annotation Name** screen, highlight the Annotation to be deleted.



2. Click the Delete button to instantly delete the Annotation from the list.

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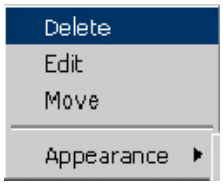
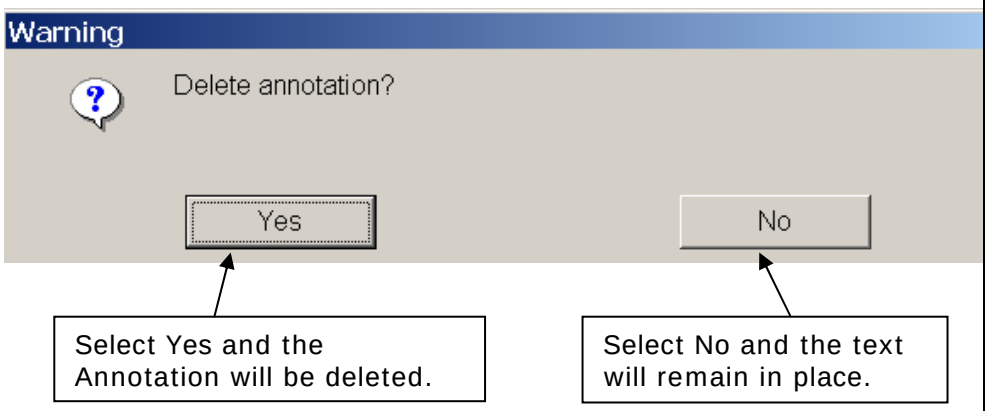
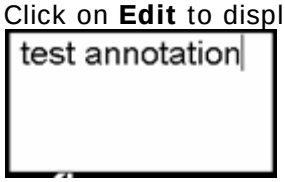
7.13.5 Delete / Edit / Move Text Annotations

Use the **Annotations** sub-menu to change Annotations. Select and position the Annotations cursor over the text Annotation and single right click. The **Annotations** sub-menu will display and select the action desired:



Delete	Click on **Delete** to remove the selected Annotation. A window will appear asking for confirmation of delete request.  Make appropriate selection. This window will close automatically and the ***Main Image*** screen will display.
Edit	**Edit** can be used to enter or change existing text Annotations. 1. Click on **Edit** to display the text entry dialog box.  2. The existing text is highlighted. 3. Enter the desired text. 4. Click outside the text box or press the Enter key to save changed text.

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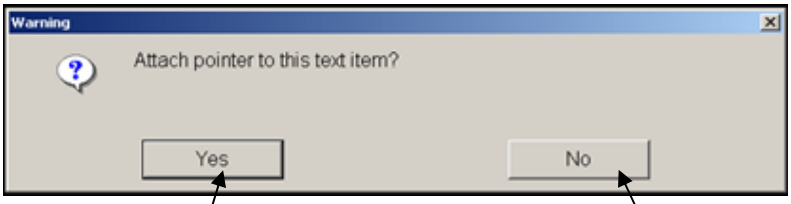
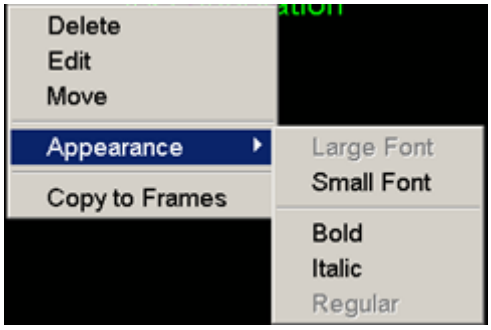
Move	The **Text Annotation** can be moved to any location within the ***Main Image*** screen. 1. Click on **Move** to activate. 2. The cursor becomes a hand and the **Text Annotation** can be moved freely within the ***Main Image*** screen. 3. Left-click the mouse when location is correct. The new position of the Annotation will be saved. **NOTE:** When moving the pointer close to a Text Annotation a window will appear asking whether to attach the Pointer to the Text Annotation:  Select Yes and the Pointer will be attached to the Annotation Select No and the pointer will move to the requested position without attaching to the Text Annotation **NOTE:** To quickly move **Text Annotations** on-screen, place cursor over the Annotation and hold down left mouse or in-room pointing device button. Drag the Annotation to required location within main image screen and then release the mouse or in-room pointing device button to relocate the Annotation.

Appearance	Select the **Appearance** button to display editing options available. The "grayed out" settings indicate the current active Annotation settings.  Example: In menu shown at the left, Annotation is set using large, regular (non-italic) font.
Large Font	Select the ***Large Font*** button to change the font of the specified Annotation from small to the larger font (default is the larger font)
Small Font	Select the ***Small Font*** button to change the font of the specified Annotation from large to small font.

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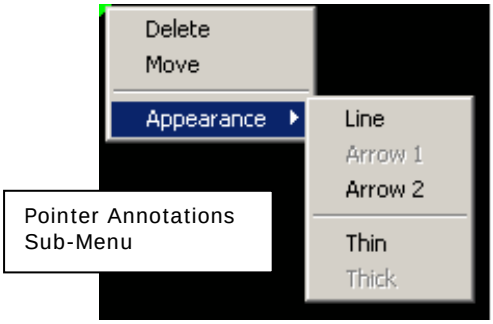
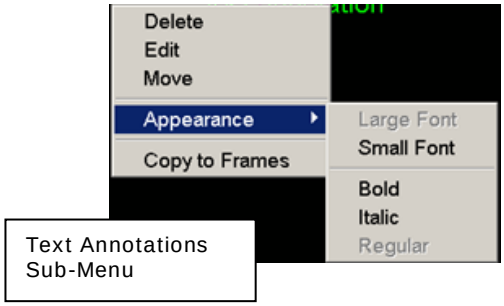
Bold	Select the ***Bold*** button to set Bold font for specified Annotation
Italic	Select the ***Italic*** button to italicize the Annotation.
Regular	Select the ***Regular*** button to disengage Bold lettering.
Copy to Frames	Select the ***Copy to Frames*** button to copy the Text Annotation to all other frames within the current sequence

7.13.6Change / Delete / Move Text and Pointer



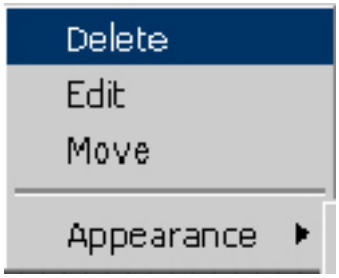
Position the cursor over the pointer to view the pointer Annotations sub-menu.

Right click over either the Arrow or the text to make changes.



7.13.6.1 Delete / Move Annotations

Position cursor over the Delete menu item.



Delete	Click on **Delete** to eliminate specific line or arrow. A window will appear asking for confirmation of delete request.

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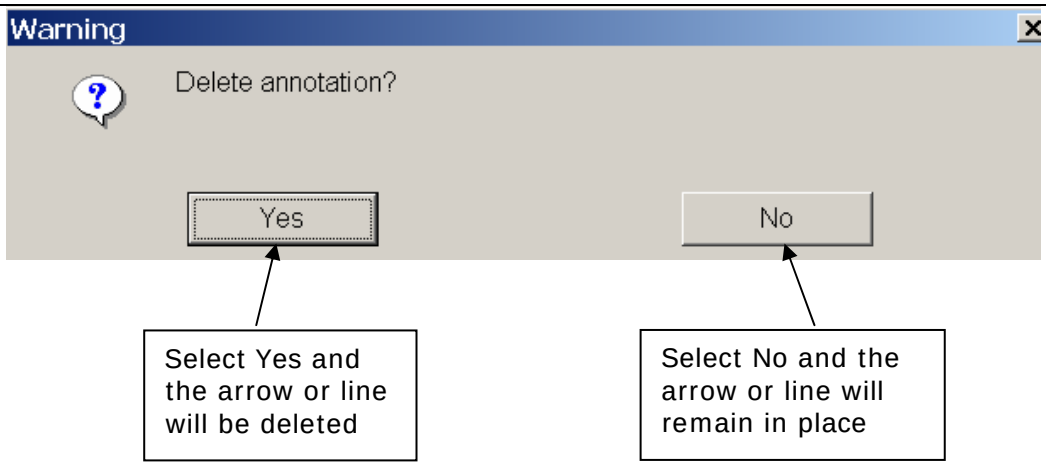

Warning
Delete annotation?
Yes
No
Select Yes and the arrow or line will be deleted
Select No and the arrow or line will remain in place

Make appropriate selection. This window will close automatically and the ***Main Image*** screen will display.

Move

The Arrow or Line Annotation can be moved to any location within the ***Main Image*** screen.

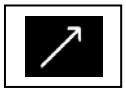
1. Click on Move to activate
2. The cursor becomes a hand icon and the arrow/line annotation can be moved freely within the ***Main Image*** screen.
3. Left-click the mouse when location is correct. The new position of the Annotation will be saved.

To lengthen or shorten arrow:

1. Place cursor over either end of the arrow and left-click
2. A box will appear at both ends of the arrow
3. Point the cursor to one of the boxes and click and hold the left button. Then adjust the length of the arrow.
4. Release the mouse when size is correct. The new size of the Arrow will be saved.

NOTE: Quickly move Line/Arrow Annotations on-screen by placing cursor over the Annotation and holding down left mouse or in-room pointing device button. Drag the Annotation to required location then release the mouse or in-room pointing device button to relocate the Annotation.

Line — Click to change the arrow to a straight line.

Arrow 1 — Click to return Annotation to default arrow 

Arrow 2 — Click to change current Annotation to alternate arrow

Thin — Click to use a finer line for the arrow.

Thick — Click to use a heavier line for the arrow.

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7.13.6.2 Moving Text and Pointer

Follow instructions in Chapter 7.13.5 to change, delete or move a text and pointer combination annotation.

NOTE: Text and Pointer Annotations can be moved together by placing cursor over the Annotation and holding down left mouse or in-room pointing device button. Drag the Annotation to required location within main image screen and then, release the mouse or in-room pointing device button to relocate the Annotation.

NOTE: When the Annotation portion of a text and pointer combination is moved, the tail of the pointer remains attached to the annotation but the head of the pointer remains in the same position.

Follow instructions in Chapter 7.13.6.1 to change or delete the pointer portion of a text and pointer combination annotation.

To move the pointer portion of a text and pointer annotation, remember:

- The head of the pointer can be moved anywhere on the screen while the tail of the pointer and the annotation remain in the same position.
- The tail of the pointer can only be moved to a different position on the annotation.
- If any part of the pointer besides the end point is selected, the entire pointer will move left or right in relation to the annotation.

NOTE: Deletion operations result in the deletion of both the text and the pointer.

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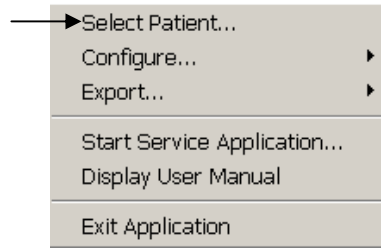
7.14 SEQUENCE TITLE EDIT

7.14.1 Sequence Title Edit from Patient List

A new title can be typed over the current entry of the combo box:

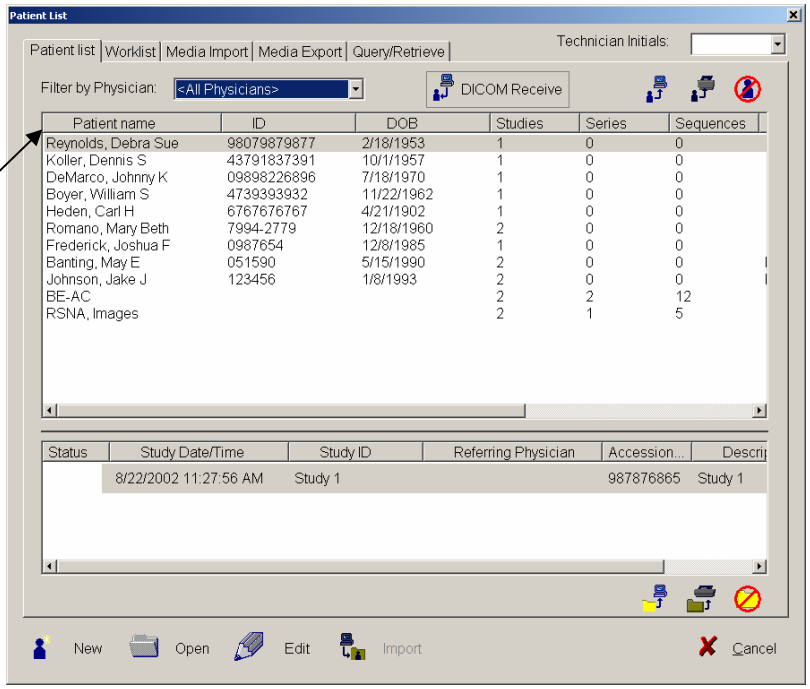
1. Right-click with cursor over the image in ***Main Image*** screen. The **Right-click** menu will display

2. Click on **Select Patient**



3. The ***Patient List*** screen will display

4. Use cursor to highlight the desired patient file and then left click.



Patient List Screen

5. Select the Edit button. The ***Patient Information*** screen will be displayed.

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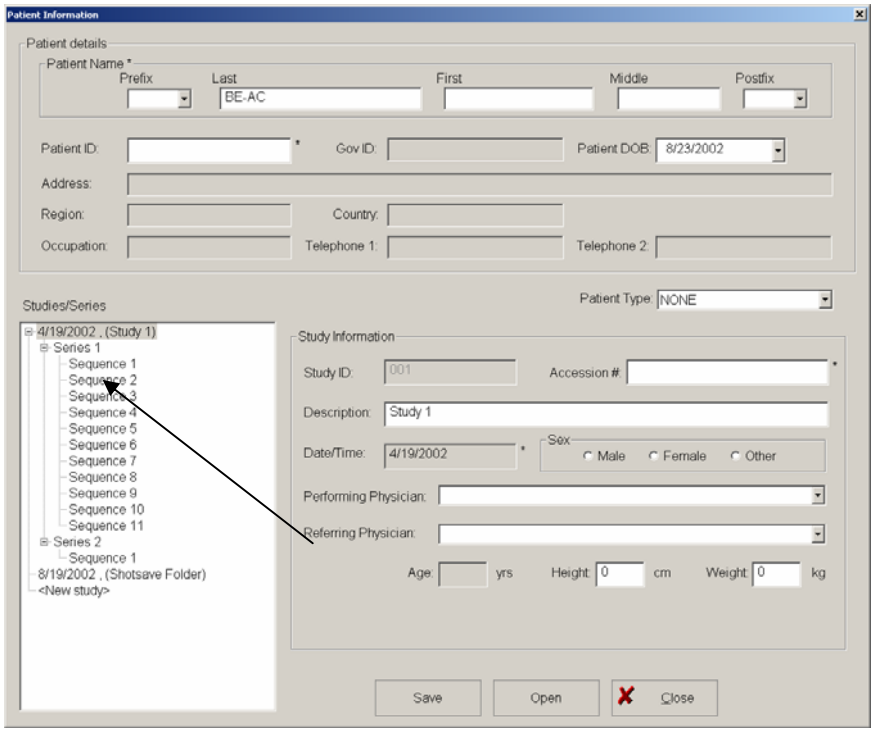
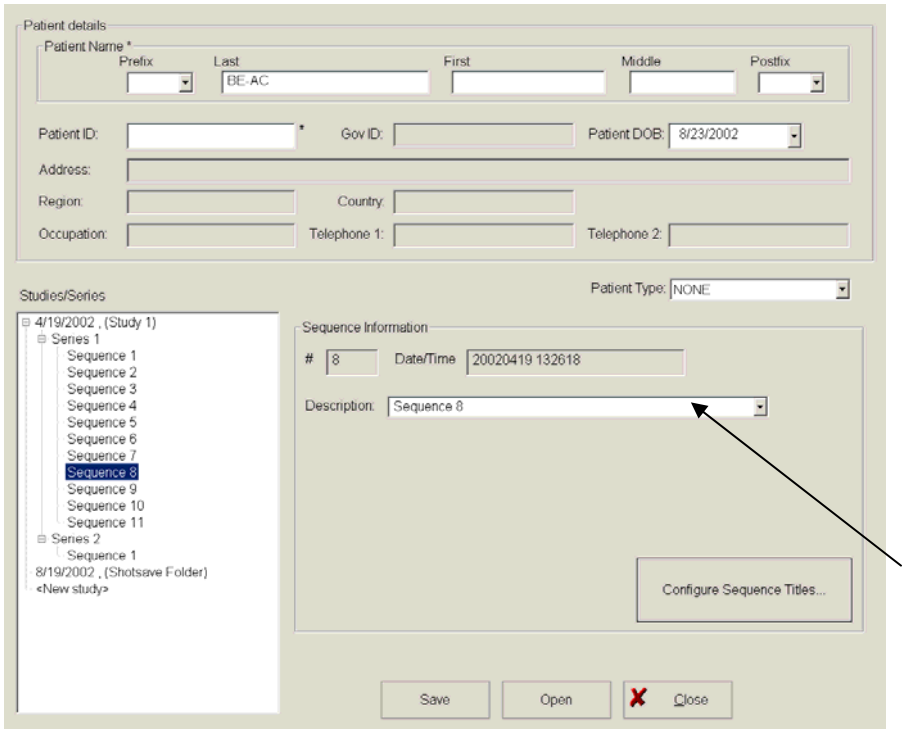


Edit Patient List Screen

6. Left click on the desired **Sequence** in the Studies/Series window
7. The screen changes to allow Sequence Title to be changed (see figure that follows)



Sequence Title Screen

8. Enter New Title in Description box and then click Save to save changes.

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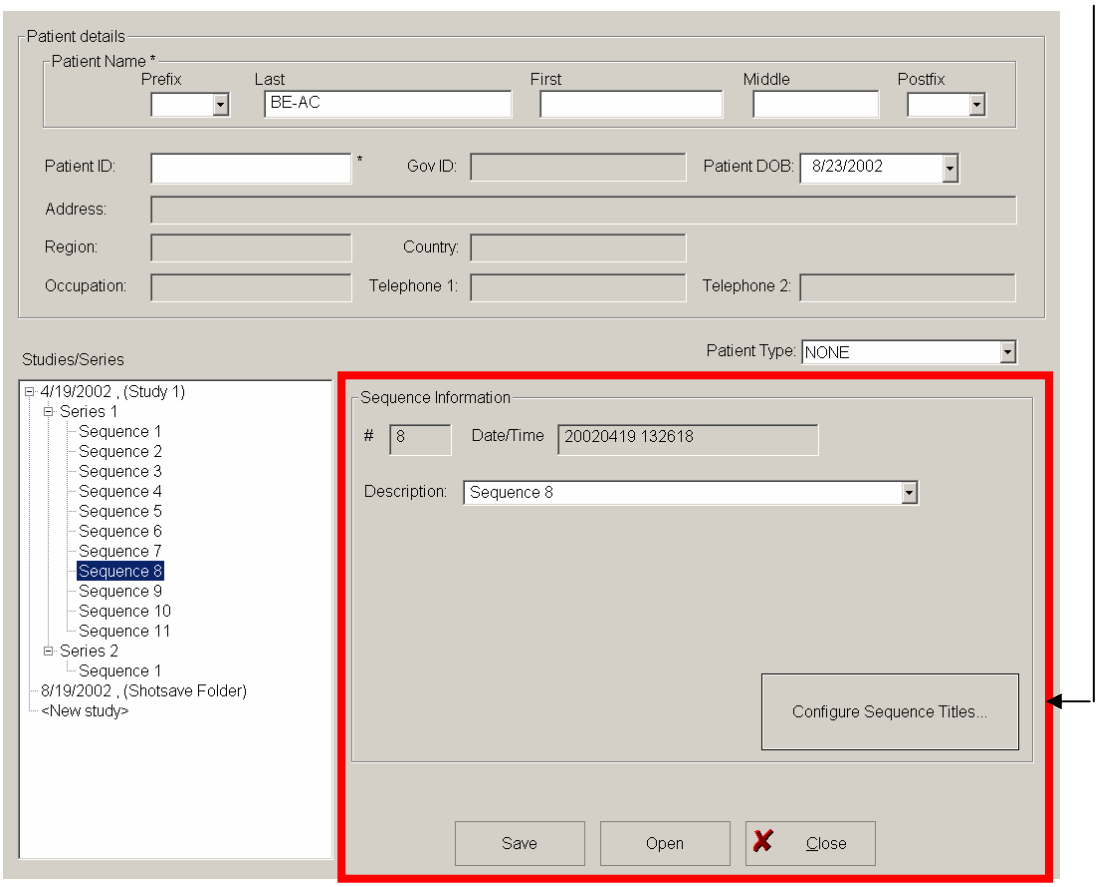
7.14.2Create a New Predefined Sequence Title

To add a sequence title that can be added to a list of predefined sequence titles for easy selection later:

1. From the ***Sequence Information*** screen, click on <Configure Sequence Titles>



2. The ***Predefined Sequence Titles*** screen will display (see figure next page).

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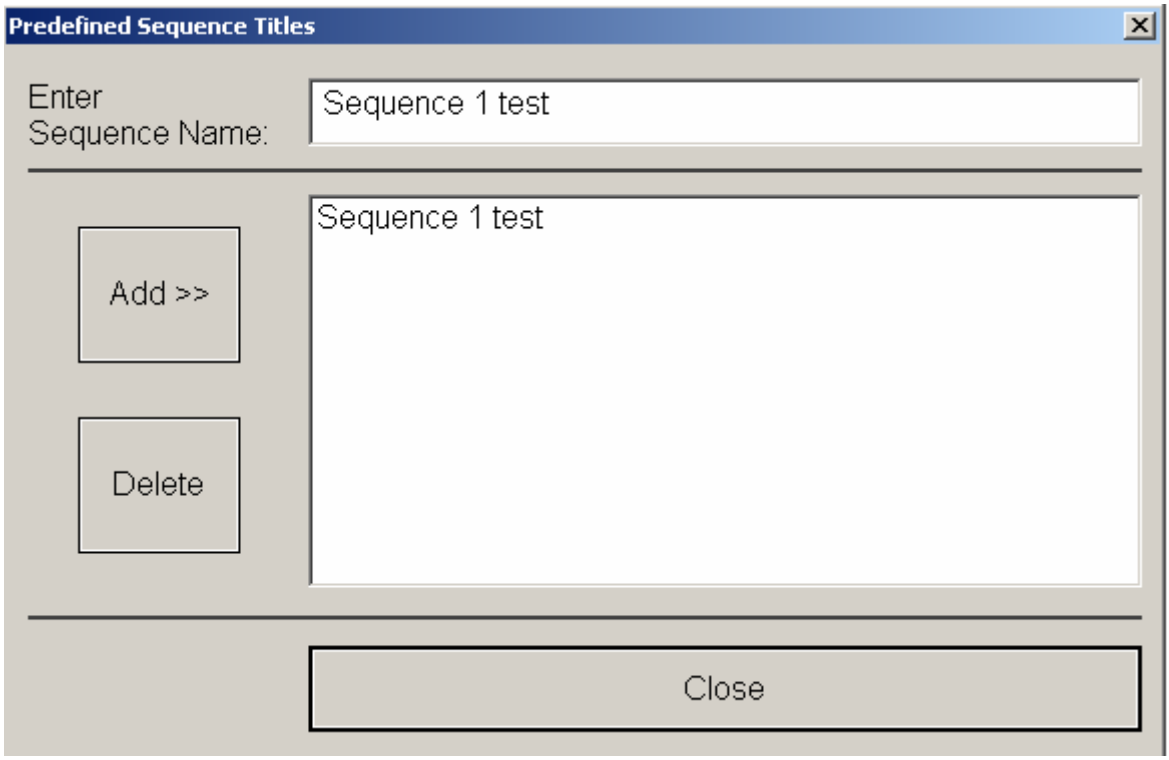

Predefined Sequence Title Dialog Box

3. Enter the Name for the Sequence, then click

.

4. Repeat step #3 to add other Sequence Titles.

5. Click

to store the new sequence titles and exit screen.

NOTE: To delete a Predefined title from the list, highlight the title and then click Delete.

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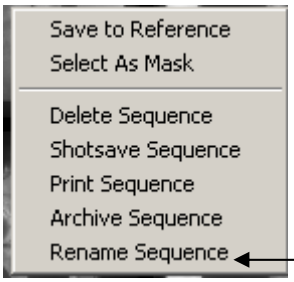
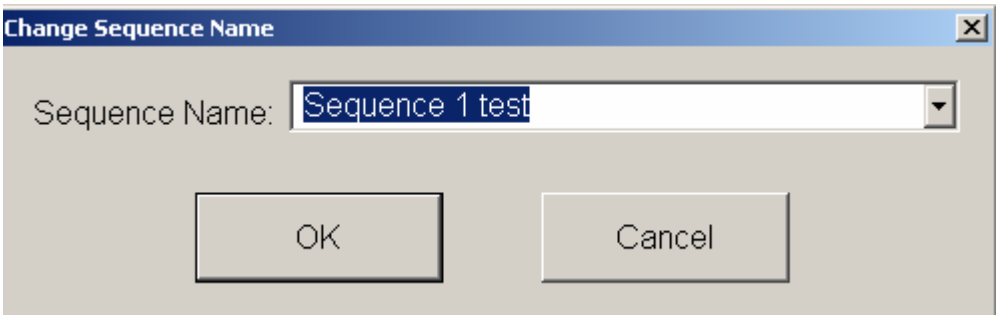
7.14.3Sequence Title Edit – Thumbnail Right Click Menu

A sequence can quickly be renamed directly from the thumbnail of the image.

1. Right-click while over the Thumbnail image to display sub-menu



2. Select **Rename Sequence**. The Change Sequence Name dialog box will display



3. Enter revised sequence title, then click OK.
4. The sequence name will be changed immediately.

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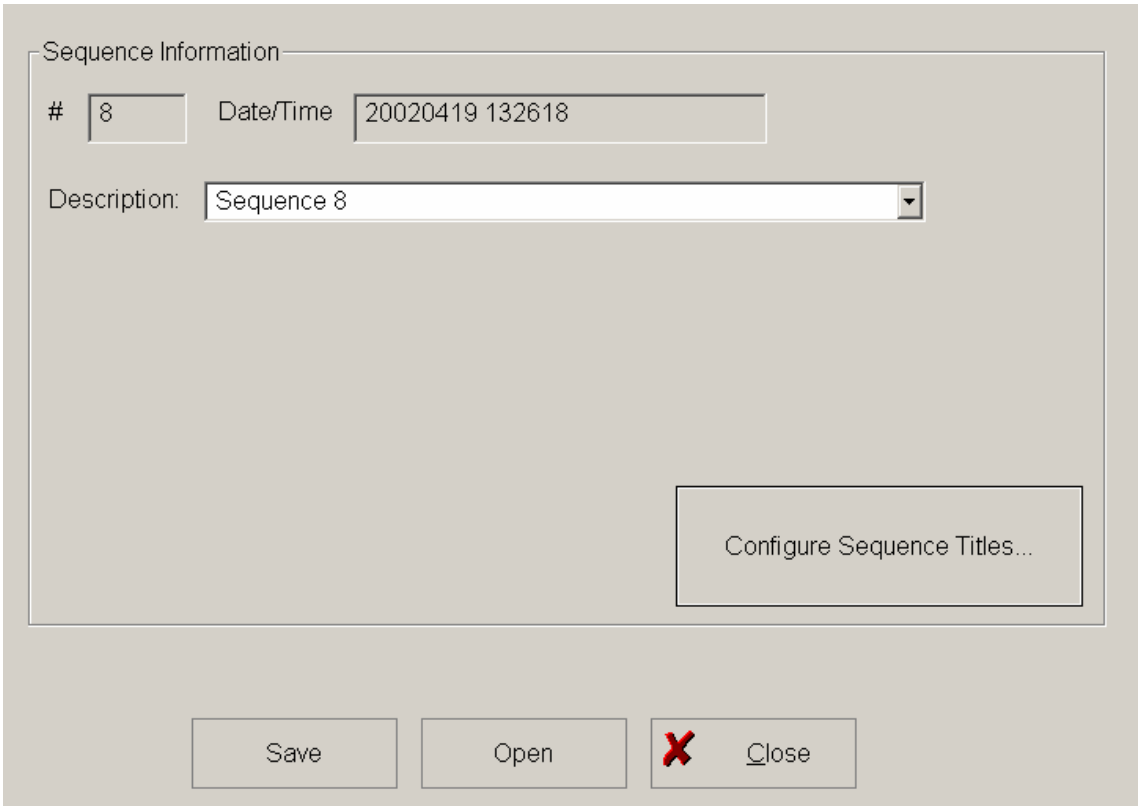
7.14.4Selection from Sequence Title Library

To select a title from the Sequence Title Library:

1. Click down arrow to view available titles next to the Description box.
2. Highlight the title to be selected
3. Click Save to save selection or Cancel to revert to previous title



Sequence Information Screen

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7.15 FLUORO VIDEO BYPASS

Live Fluoro is displayed on the Primary In-room monitor with no obstructing graphics or text any time that fluoro radiation is active. The live image replaces the current review image. The last complete frame of image data acquired becomes the new LIH image placing the system into the Acquisition LIH state when fluoro radiation is terminated.

7.16 IMAGE STACKING (DSA ONLY)

In DSA, x-ray images of arterial blood vessels are taken both before and after the introduction of a dye. The system subtracts one set of data from another with the resulting image showing only the dye and, therefore, the shape of the artery through which the blood is flowing. Arterial shape is important in the determination of possible circulatory problems aiding in the diagnosis of heart disease and other circulatory disorders.
Use the Image Stacking feature to consolidate a series of images into a single image showing the blood vessel completely filled with contrast media. The term Image Stacking is used as a general term covering the following specialized features:

- Maximum Opacification
- Minimum Opacification
- Multi-Mask (also called Frame Averaging)

Images can only be Stacked if they are part of the same sequence. If an attempt is made to Stack images from different Sequences, a warning will display.

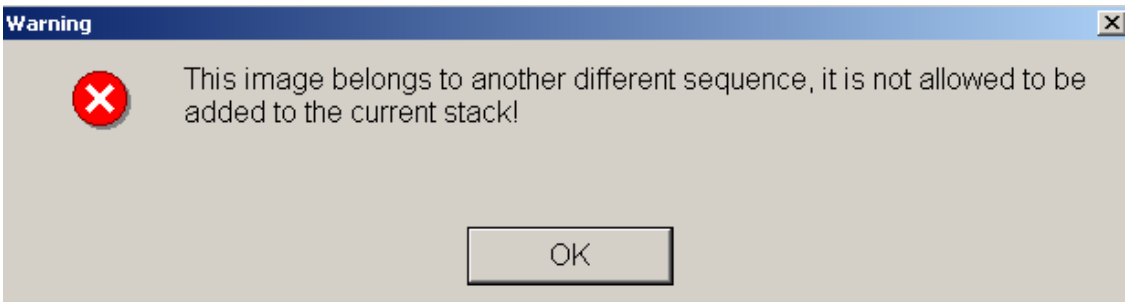
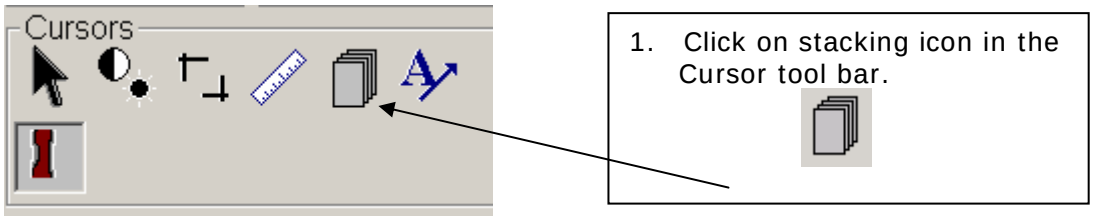


Image Stacking is selected via the **Cursor Tool Bar**



DSA Cursor Tool Bar

2. The Image Stacking window will replace the ***Standard Control Box*** in the upper left of the Main Image screen and the cursor will become a stack .

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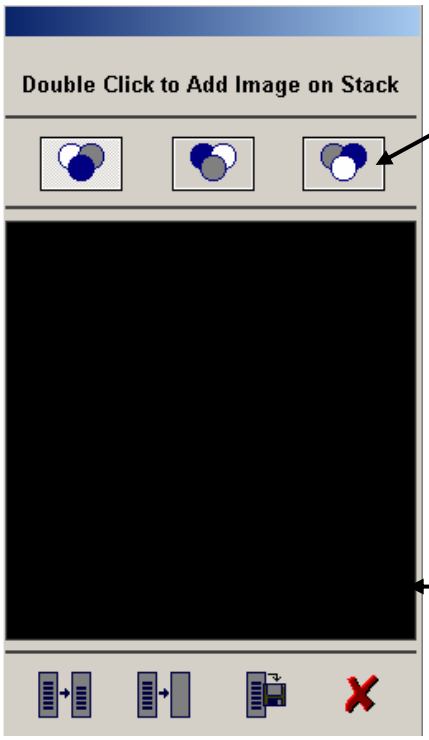
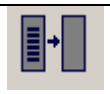
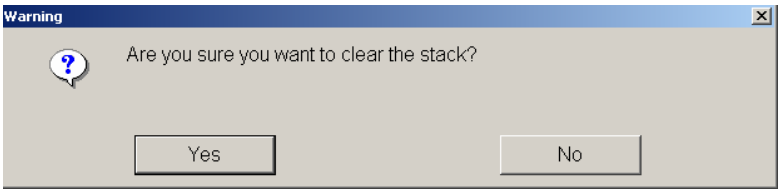


3. Double left click on each individual image to be added to the stack. As each image is added to the window, the composite image will be updated to reflect the addition of the new image.

Use the buttons on a tool bar for selecting the type of stacking to perform: Average, Maximum Opacification, or Minimum Opacification; and otherwise manage the Image Stacking function.

Image Stacking User Interface

Image Stacking User Interface Buttons	
	Click for Maximum Opacification
	Click for Frame Averaging
	Click for Minimum Opacification
	Click to undo last stacking action. No warning will display
	Click to clear stacking. The following warning will display. 
	Click to save the stacked image and close the stacking interface. No warning will display.
	Click to cancel the stacking feature.

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7.17 REAL-TIME MASK SUBTRACTION

Also referred to as Masking, this feature allows for the subtraction of the current image from a mask image in order to enhance viewing dye contrast within the vein. On DSA systems mask subtraction is made real-time.

Photo-spot Sequences - Activation / Deactivation

To Activate Subtraction:

1. Single click the Mask button in the ***Expanded Control Box*** with the mouse or in-room pointing device to activate subtraction using the current image as the Mask.

Mask Button

2. The button will appear depressed on the screen

To Deactivate Subtraction:

1. Single click
2. The current image will display unsubtracted, using that image's default image processing settings.
3. The mask button will return to its previous state.

Selectable Mask

The image that is currently displayed when subtraction is activated will be used as the mask.

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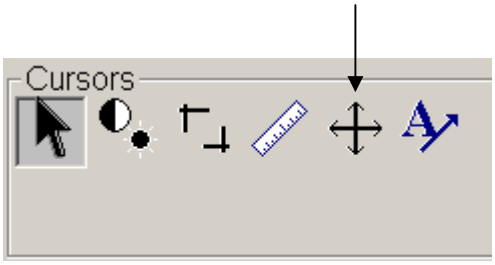
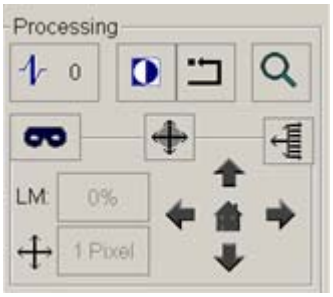
7.18 RE-REGISTRATION

If a subtracted image is not properly aligned with the mask image, the mask image can be moved pixel-by-pixel in any direction until aligned.

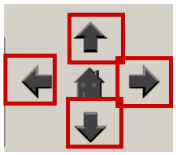
The mask image can be re-registered by selecting the re-registration cursor from the Cursor tool bar. This cursor will not appear on the Cursor Tool Bar unless the image that is displayed is a subtracted image.



The mask image can also be reregistered by left-clicking on the arrow buttons surrounding the Home icon.



The mask image can also be re-registered by left-clicking on the arrow buttons ➡ surrounding the home icon.



To return the mask to its default position, click in the ***Expanded Control Box***.

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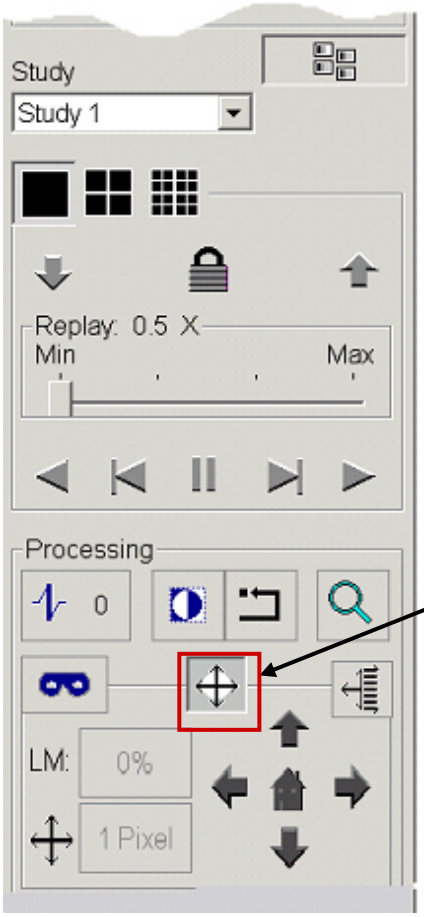
7.19 SPLIT RE- REGISTRATION (BC/RA MODE ONLY)



On pressing the Re-registration button the same amount of Re-registration will be applied to the subsequent stations in the Bolus Sequence.

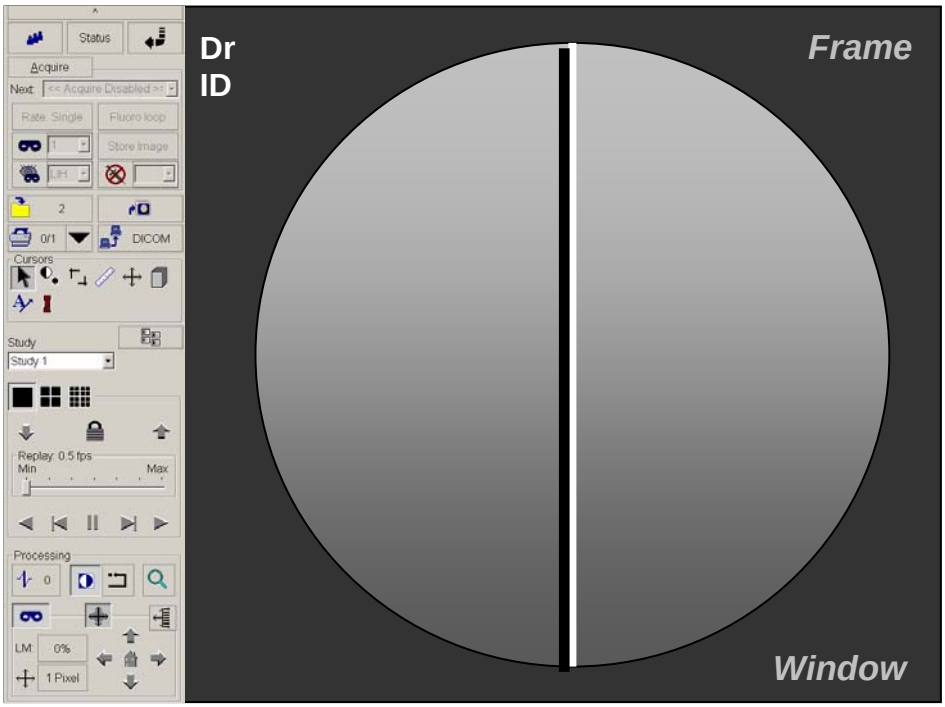
The Carry Over button resumes the On State after this operation is completed and is ready to be used for Carrying Over further shifts made on the active image.

3-State Split Re-registration button:

- State 1 –Full-Screen Re-registration
- State 2 – Left Re-registration
- State 3 - Right Re-registration

NOTE:

If BC/RA is not Enabled, the Carry-Over button and the 3-State Split button will not be visible.



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7.19.1 Split Screen Button – One-on-One Mode

A 3-State button will be added to the Re-registration Group of controls at the bottom of the Processing Panel. If the image displayed on the Primary Monitor is a Bolus Chase Sequence, then the Three-State Split-screen button gets Enabled.

7.19.2 State 1 – Full-Screen Re-registration

This is the Default State . The button is not pressed. The user is allowed to make Registration for the full image (0 – 1024 pixels). The Re-registration Cursor will be visible in this state. The Re-registration Operations will be similar to those in Precision MPi.

7.19.3 State 2 – Left Re-registration

If the button is clicked once, the user is allowed to make registration for the **left half of the image (0-512 pixels)** **.** The Re-registration Cursor will not be visible in this state. The Arrow button controls provided on the left side control panel can be used to perform Re-registration. A vertical, full-height, two-tone line will appear at the center of the primary image. The six pixel wide line will be white on the left and black on the right, indicating the left side of the image is active for Re-registration.

7.19.4 State 3 - Right Re-registration

If the button is clicked again, the user is allowed to make Registration for the **right half of the image (513 – 1024 pixels)** . The Re-registration Cursor will not be visible in this state. The Arrow button controls provided on the left side control panel can be used to perform Re-registration. A vertical, full-height, two-tone line will appear at the center of the primary image. The six pixel wide line will be, black on the left and white on the right, indicating the right side of the image is active for Re-registration.

Upon clicking the button again it goes back to the original state, i.e., full Re-registration.

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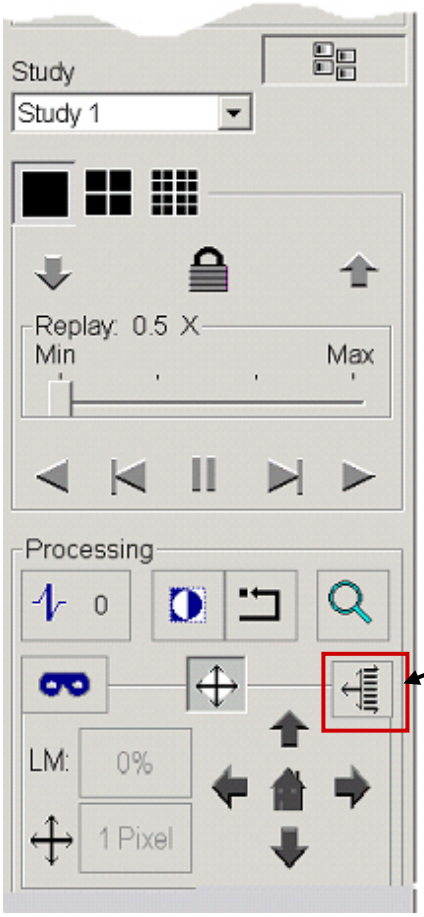
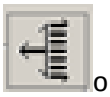
7.20 CARRY-OVER RE-REGISTRATION (BC/RA MODE ONLY)



The Carry Over button  on the Main GUI Panel is used to apply the same amount of Re-registration to the subsequent frames.

The Carry Over button is Enabled only in Re-registration modes. The button will remain Disabled until a Re-registration operation is performed on the image.

Carry-Over
Re-registration button

NOTE:

If BC/RA is not Enabled, the Carry-Over button and the 3-State Split button will not be visible.

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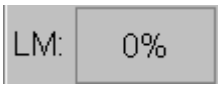
7.21 LANDMARKING

Once the Mask button is selected, the Landmarking Percentage (%) button will be activated on the screen.

Landmarking allows the selection of the percentage of the mask image that is to be added back into the subtracted composite image. This will enable the visualization of some background image data for orientation or other purposes.

To activate Landmarking:

1. Click on Landmarking button in the ***Lower Processing Panel***.



Click button to cycle through percentages. The current setting will be shown on the button. Available settings for this feature are:

0% - 10% - 25% - 50% - 100%

The higher the percentage, the higher the visibility of the mask image.

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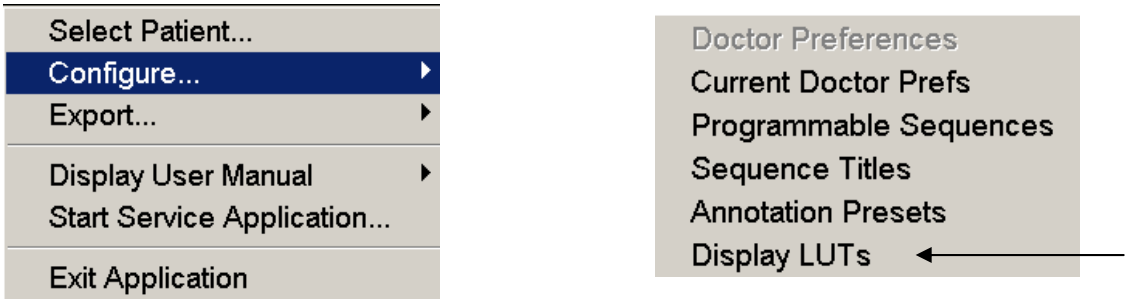
7.22 DISPLAY LUTS (LOOKUP TABLES)

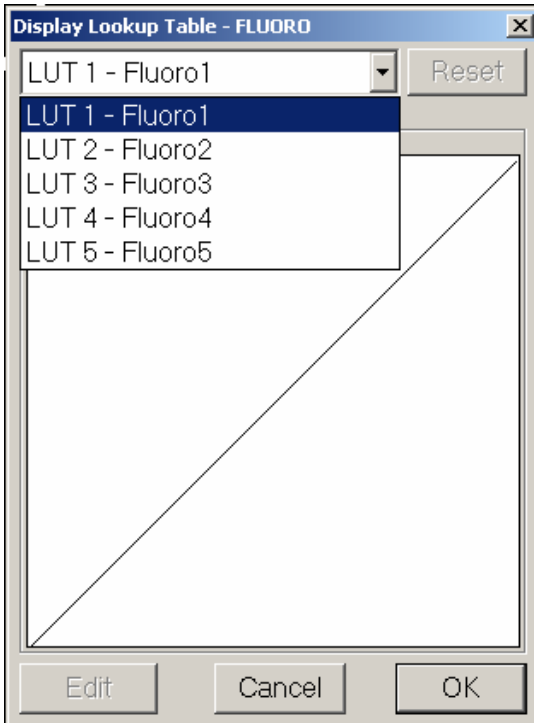
This feature allows for more advanced customization of Lookup Tables (LUTs), by allowing adjustment of the LUT setting during image review. This procedure will override the default setting made in Doctor Preferences and can either be saved as the new default, or used for the specific image being reviewed. Use the following steps to modify default settings:

1. Right click over the main image screen. The right-click menu will display.

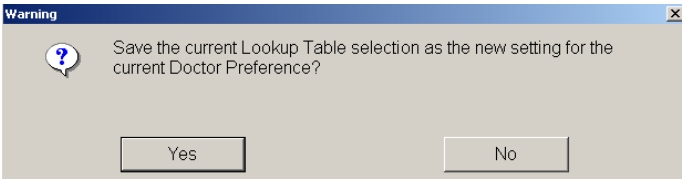
2. Position the cursor over Configure to bring up the sub-menu.



3. Click on "Display LUTs" and the ***Display Lookup Table*** modification screen will display.



4. Click on down arrow to display the available selections. Position cursor over desired selection and click and click OK. You will be prompted as to whether or not you want to save this selection as the new Doctor Preference setting.



Click Yes to save as new default or No to leave the default as previously set.

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8.1 Printer Setup

System printers are added or deleted within the *Service Applications* function. Contact your service department for complete instructions.

NOTE:	Service Applications must only be performed by a trained service representative. Please contact the network administrator for assistance in this area.

8.2 Printing an Image

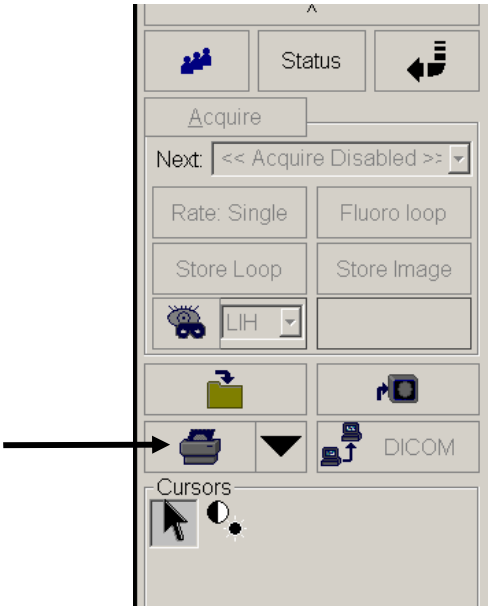
The first time Expose is used for the active frame, a new study called Print ShotSave is created and the image/frame is saved to that study and printed from that Folder. The letter “S” will appear in the lower right corner of the main image screen to document this action.

Each time an additional study is opened and Expose used, the image/frame will be added to the existing Print ShotSave Folder.

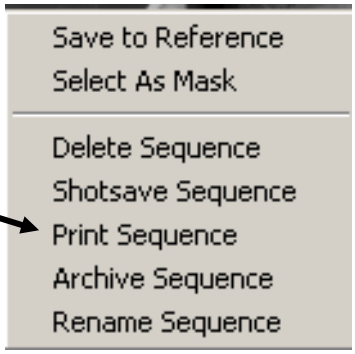
The current image can be printed during any mode of operation using the **Expose** button.

The image will print using ***Doctor Preference*** settings. Use ***Configure Expose*** to change default settings. See Chapter 8.2.2.

1. Click . The Print Shotsave folder will be created and the image/frame sent to that folder from which it is printed.
2. An “S” will appear in the lower right portion of the screen indicating the creation of this folder.



The only way to create a **Print Shotsave Folder** is to use the thumbnail right click menu (Print Sequence).



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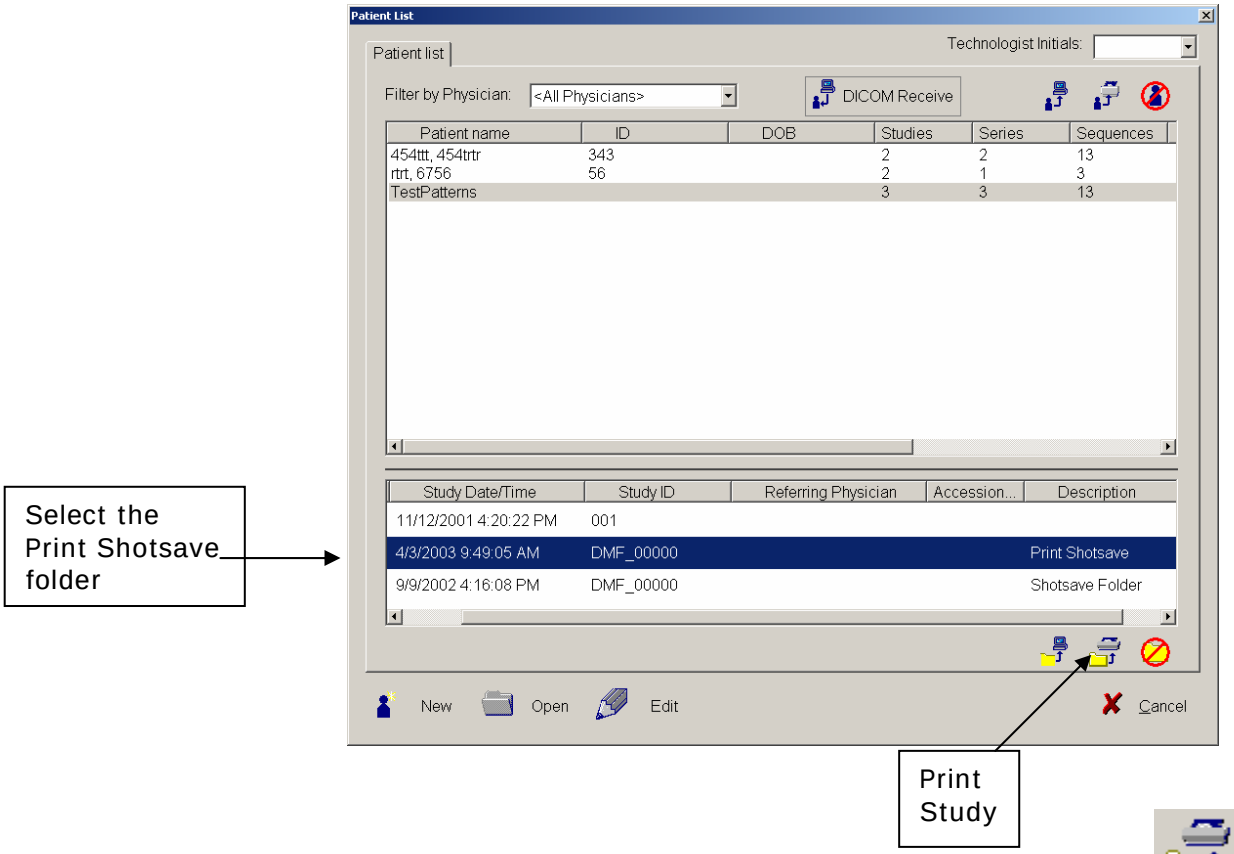
8.2.1 Accessing Print Shotsave

From the Patient List Screen

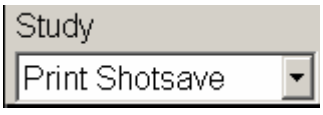
The Print Shotsave folder will appear as part of the directory in the lower portion of the Patient List screen.



The entire folder can be printed from the Patient list screen by selecting Print Study .

From the Main Image Screen

Use down arrow to access drop-down menu under Study. Scroll the list to find Print Shotsave. Thumbnails representing sequences in this folder will display.



NOTE:	The maximum number of images in the Print Shotsave folder can be configured in the service application. Images beyond the maximum number as set in the Service Application will automatically be deleted when the clinical application is closed and restarted. The oldest images are deleted first.

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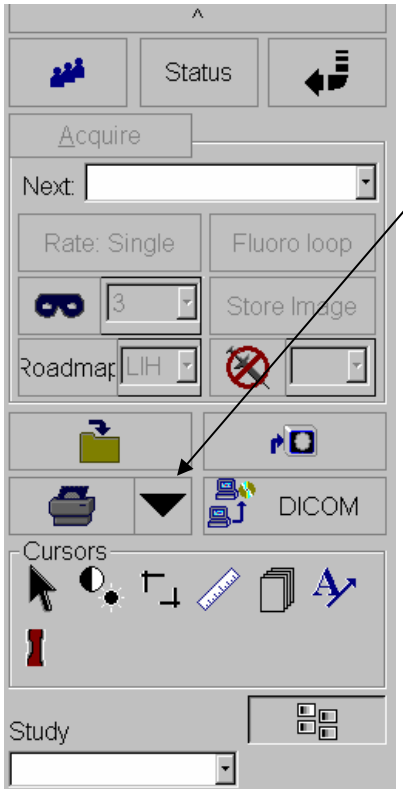
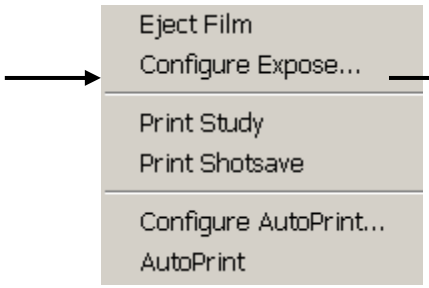
8.2.2 Configure Expose

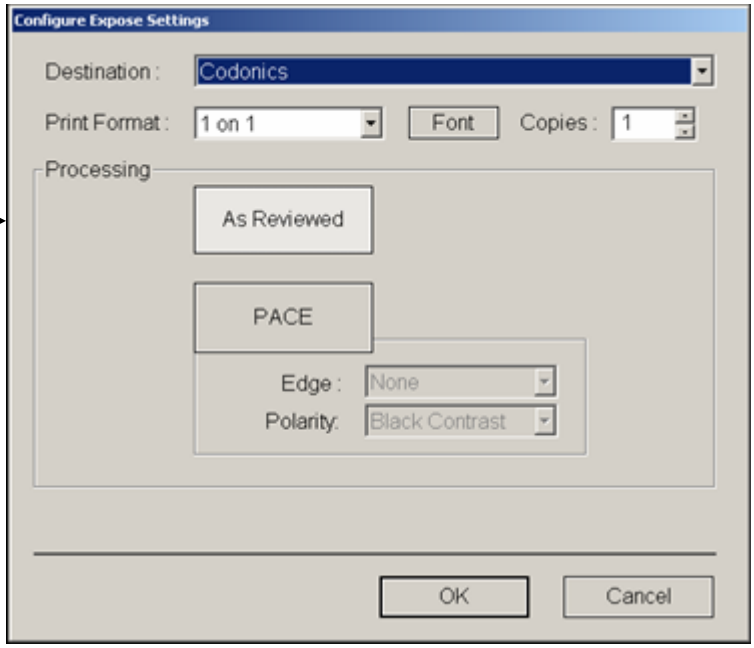
Use this screen to set print parameters for current patient file.



1. To access this feature, click the arrow next to the **Print** button.

2. The ***Print Layout*** sub-menu will display.
3. Click on **Configure Expose**.
4. The ***Configure Print Settings*** window will appear over the image portion of the screen.





Configure Print Settings Window

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At this window, the processing defaults used for printing images can be changed.

<table>
<tr><td colspan="2">Destination : DICOM Agfa
Click to display available printers and highlight to select printer for job to be performed.</td></tr>
<tr><td>Print Format :</td><td>Select number of images to be printed on each film. To display options, click . Ranges from 1-on-1 to 12-on-1 (printer specific)

1 on 1
2 on 1 Vertical
2 on 1 Horizontal
4 on 1
6 on 1
9 on 1
12 on 1

Use up and down arrows within sub-menu to display all available formats.</td></tr>
<tr><td>Copies :</td><td>Enter number of copies (of each image) to be printed or use the up and down arrow keys to increment to the desired number (100 copies maximum).

1</td></tr>
<tr><td>Processing</td><td>Choose which processing features should be used for the printed image.

As Reviewed

Click this button to print with features applied when image was last reviewed.

PACE

Click PACE button (Post-Acquisition Copy and Enhance) to select Edge Enhancement and Contrast for this printing. The PACE feature automatically enhances images as they are sent to the printer.

Clicking PACE will activate Edge and Contrast buttons. Only when PACE is activated can changes be made to Edge or Contrast within the Print function.</td></tr>
<tr><td>Edge :</td><td>Select level of Edge Enhancement by using to display available settings. Highlight to select.

1
1
2
3
4</td></tr>
</table>

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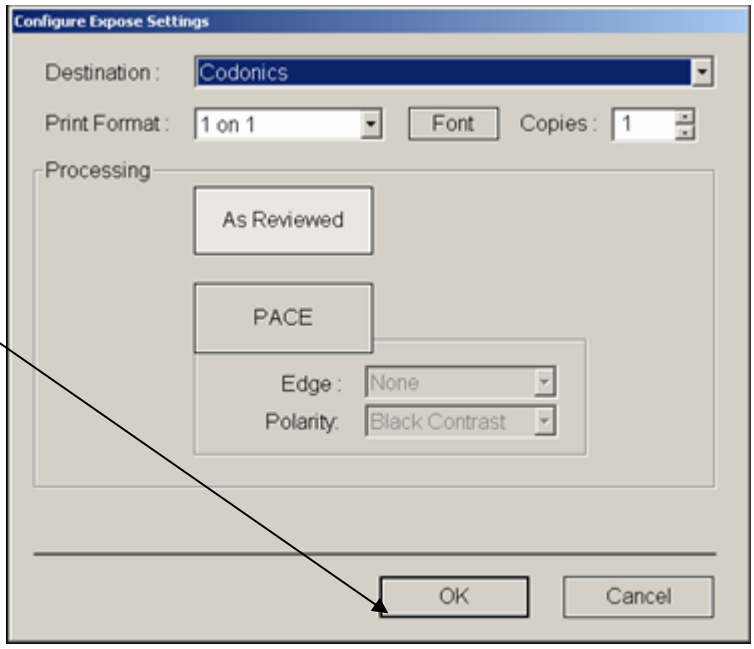
Polarity:	Select Polarity by using ▼ to display available settings. Highlight to select.

When changes have been made click OK to save and close ***Configure Expose Settings*** window.



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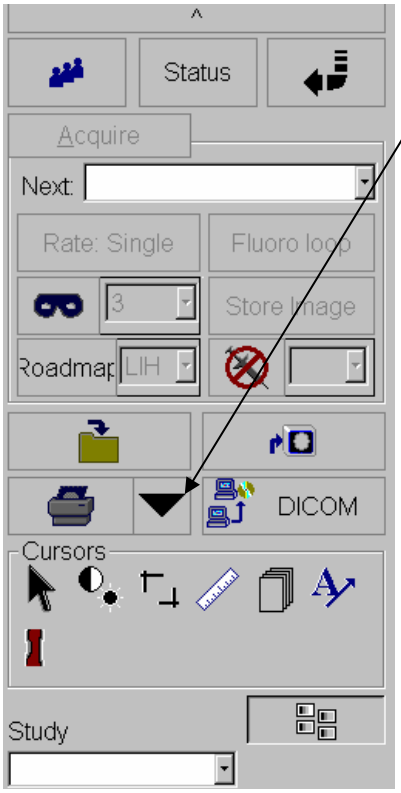
8.3 Eject Film

Use this feature to override the format setting and print a sheet with a different number of prints than what was originally configured.

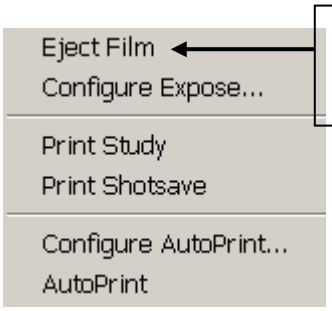
For example, if the system was configured to print 6-on-1 but only three images have been acquired, the printer will not print until six images are acquired – even if the print button is pressed.

The print feature allows for acquired images to be printed, despite the Printer Format.



1. To eject film, click the arrow on the **Expose** button .

2. The ***Print Layout*** sub-menu will display.



3. Click on **Eject Film** button.

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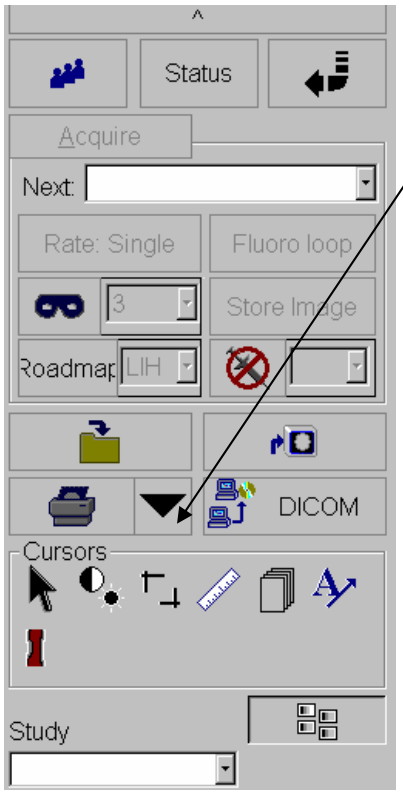
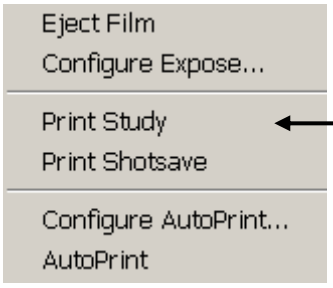
8.4 Print Study



1. To print all the images in a study, click the arrow on the **Print** button .

2. The ***Print Layout*** sub-menu will display.

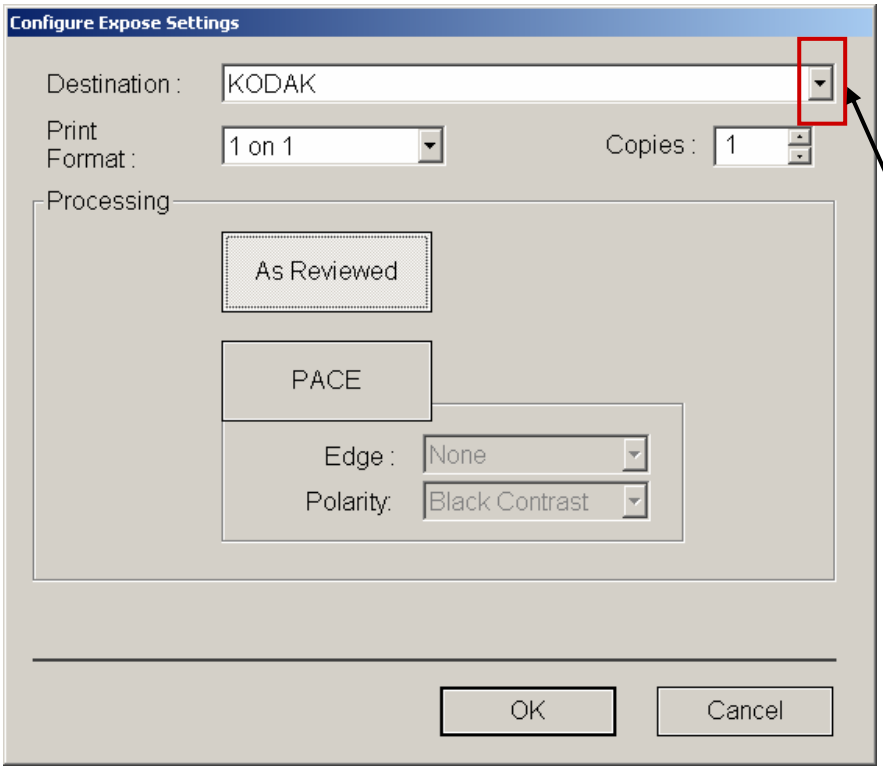


3. Click on **Print Study.**

4. The ***Configure Print Settings*** window will appear.

5. Make appropriate selections and then click **OK**.

The images for the current study will be sent to the selected printer.



Click *Down Arrow* to change printer selection.

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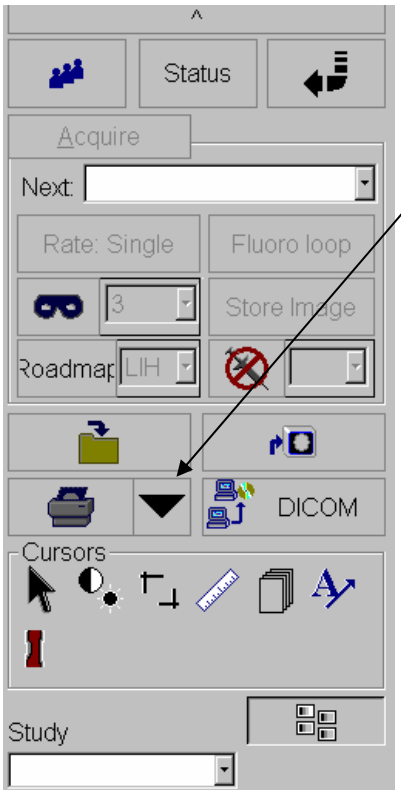
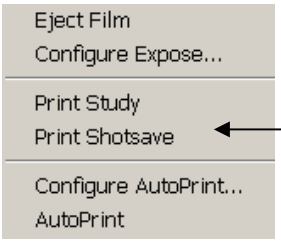
8.5 Print ShotSave

All the images in the Shotsave file can be quickly printed.

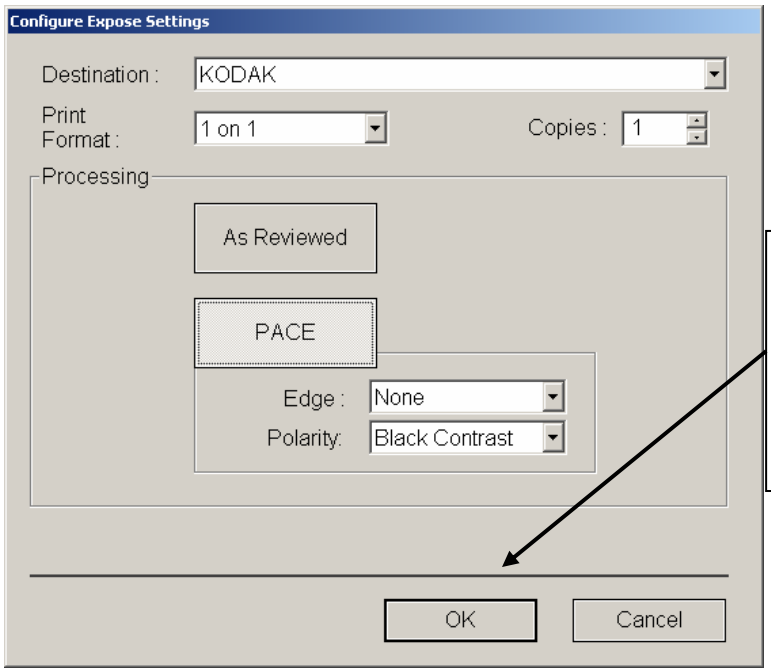


1. To print the Shotsave file images, click the arrow on the **Expose** button.

2. The ***Print Layout*** sub-menu will display:



3. Click on **Print Shotsave**
4. The ***Configure Print Settings*** window will appear.



5. Make appropriate selections and then click OK.
6. All images in the Shotsave file will be printed.

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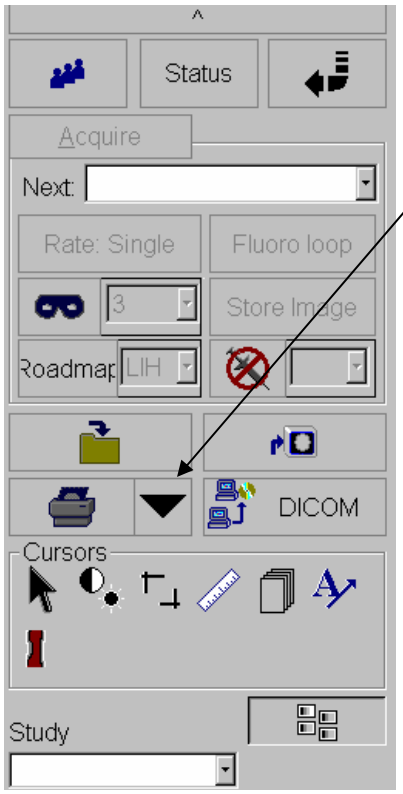
8.6 Configure AutoPrint Features

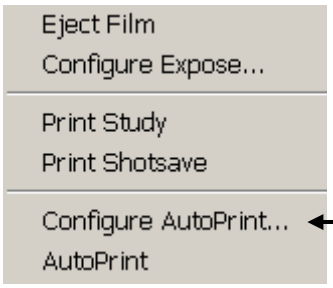
When the AutoPrint feature is ON, the system sends each image (for the current patient file only) to the printer as it is acquired with PACE parameters applied (if enabled).

Use these instructions to set the parameters that will be used for the images printed using the AutoPrint feature. (Turning the **AutoPrint** feature ON/OFF is in Chapter 8.7).



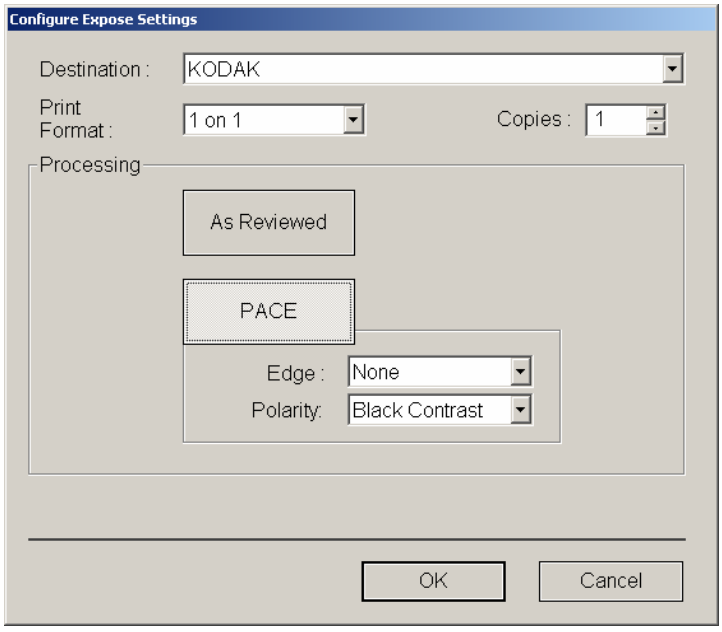
1. To access this feature, click the arrow next to the **Print** button.

2. The ***Print Layout*** sub-menu will display:



3. Click on **Configure AutoPrint**.

4. The ***Configure Print Settings*** window will appear.



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At this window, the processing defaults used for printed images can be changed.

<table>
<tr><td colspan="2">Destination : DICOM Agfa
Click ▼ to display available printers and highlight to select desired printer.</td></tr>
<tr><td>Print Format :</td><td>Select number of images to be printed on each film. To display options, click ▼. Ranges from 1 to 12 images per sheet of film. Use up and down arrows within sub-menu to display all available formats.

Windows printers have available ranges from one to four images per sheet of film.
1 on 1
2 on 1 Vertical
2 on 1 Horizontal
4 on 1

DICOM printers have available ranges from one to twelve images per sheet of film.
1 on 1
2 on 1 Vertical
2 on 1 Horizontal
4 on 1
6 on 1
9 on 1
12 on 1</td></tr>
<tr><td>Copies :</td><td>Enter number of copies (of each image) to be printed or use the up and down arrow keys to increment the number of copies to be printed (100 copies maximum). 1</td></tr>
<tr><td>Processing</td><td>Choose which processing features should be used for the printed image.

PACE

Normal
Black Contrast
White Contrast

Click PACE (Post-Acquisition Copy and Enhance) to select Edge Enhancement and polarity for this printing. The PACE feature automatically enhances images as they are sent to the printer.

Clicking on PACE button will activate Edge. Only when PACE is activated can changes be made to Edge or Polarity within the Print function.</td></tr>
<tr><td>Edge :</td><td>Select level of Edge Enhancement by using ▼ to display available settings. Highlight to select.

1
1
2
3
4</td></tr>
</table>

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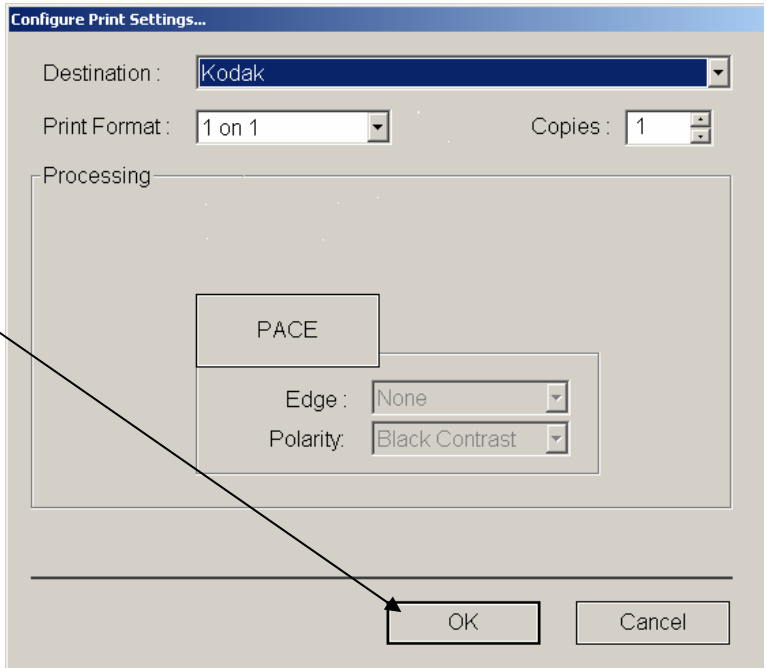
Polarity:	Select Polarity by using to display available settings. Highlight to select the desired contrast.

When changes are complete, click **OK** to save and close window.



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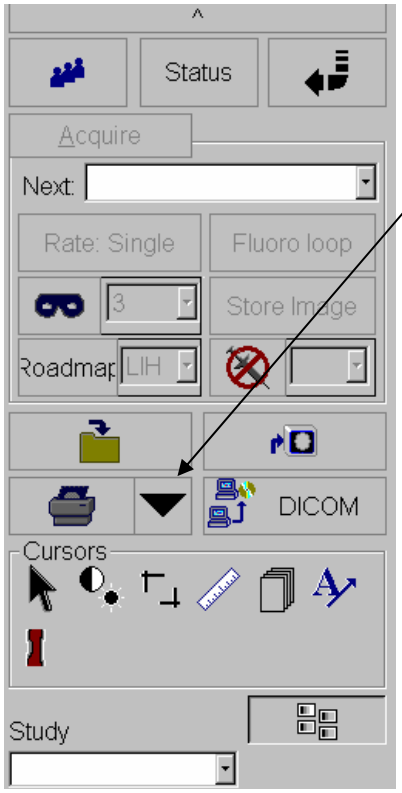
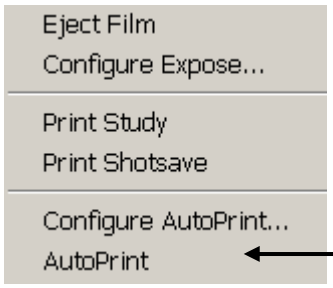
8.7 AutoPrint

When the AutoPrint feature is ON, the system sends each image (for the current patient file only) to the printer with PACE parameters applied (if enabled) as the image is acquired.



1. To turn ON the AutoPrint feature click the arrow next to the **Print** button.

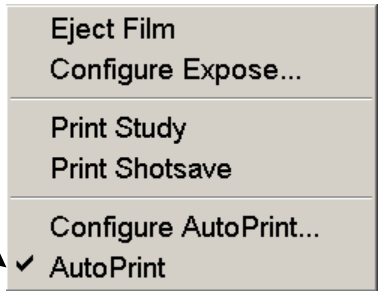
2. The ***Print Layout*** sub-menu will display:



3. Click on **AutoPrint** to enable this feature.

4. When AutoPrint is enabled, a checkmark (√) will appear in the box.

To check whether or not AutoPrint is enabled, reopen the ***Print Layout*** sub-menu and look for the checkmark.



NOTE: This feature will remain active for the current patient file until it is turned off. This feature can be turned OFF by reopening window and clicking on ✔ AutoPrint.

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8.8 Archiving Images

The DIS offers several image transfer options providing ample flexibility for patient data handling.

These features allow both images and patient data to be sent and received between the DIS and a DICOM 3.0 compatible network device or a Compact Disk Recorder/Player. The archival of images prevents loss as well as keeps the system from becoming full. Additionally, networking allows for images to be retrieved from any station on the network.

Entire patient files, selected runs or, ShotSave files, if they exist, may be selected for transfer. All the patient data will be sent when transferring images.

8.9 Importing Files

When images are archived to a separate device (central storage network or CD for example), it is sometimes necessary to bring back (*import*) the patient files and images to the DIS for review or for comparison with more recent studies.

Images can be imported from a network location using a DICOM network connection or imported directly from a DICOM CD using the CD drive.

8.9.1 Import From CD

NOTE:	DIS does not provide the capability to review images directly from a DICOM CD. It does allow you to import the patient file and images to be imported into the local database for review.

1. At the ***Main Image*** screen, click to display the ***Patient List*** screen.
2. At the ***Patient List*** screen, click on the Media Import tab. A new menu will open (see Figure below).
3. Select the CD **Media device** name.

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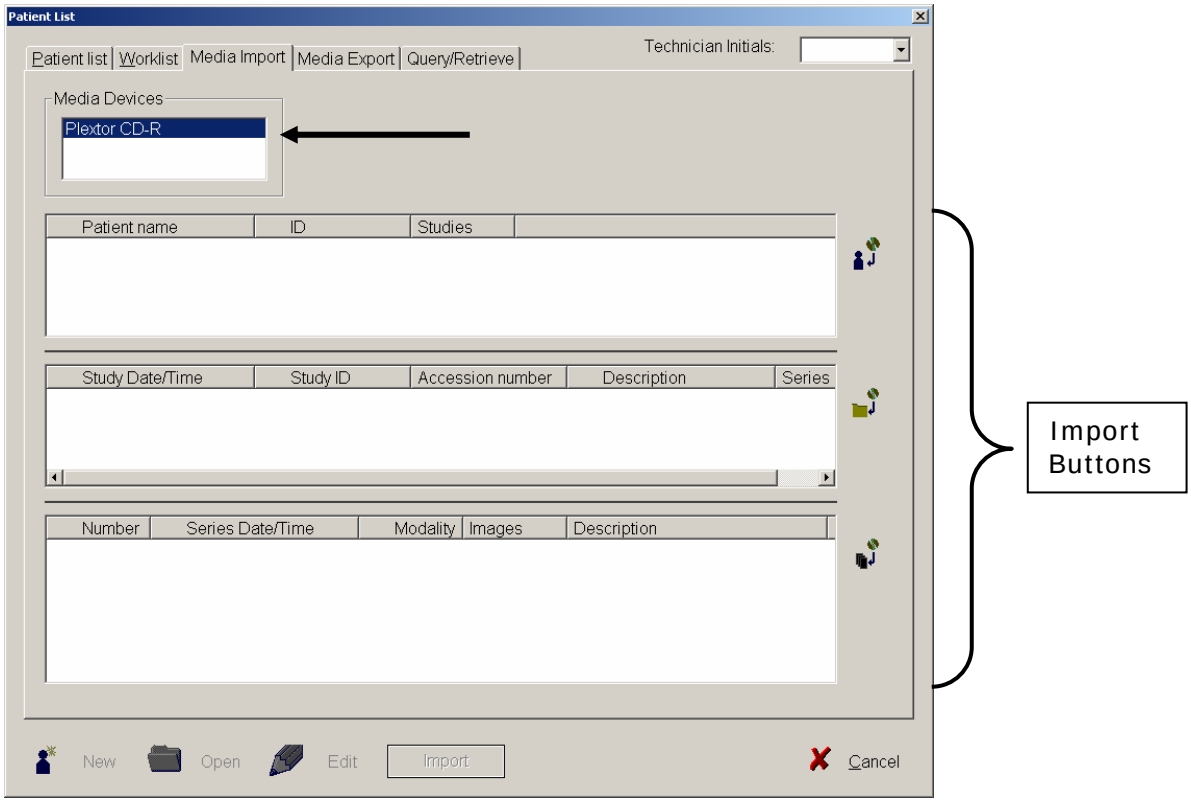

Media Import Screen

4. A list of available Files/Studies/Series will display in the corresponding pane of the Media Import screen.

5. Highlight the **Patient**, **Study**, or **Series** to be imported.

6. Select one of three available import buttons (see chart below for descriptions).

Button	Action
	Transfers **entire patient files** from source media device
	Transfers **specific studies** from source media device
	Transfers **specific series** from source media device

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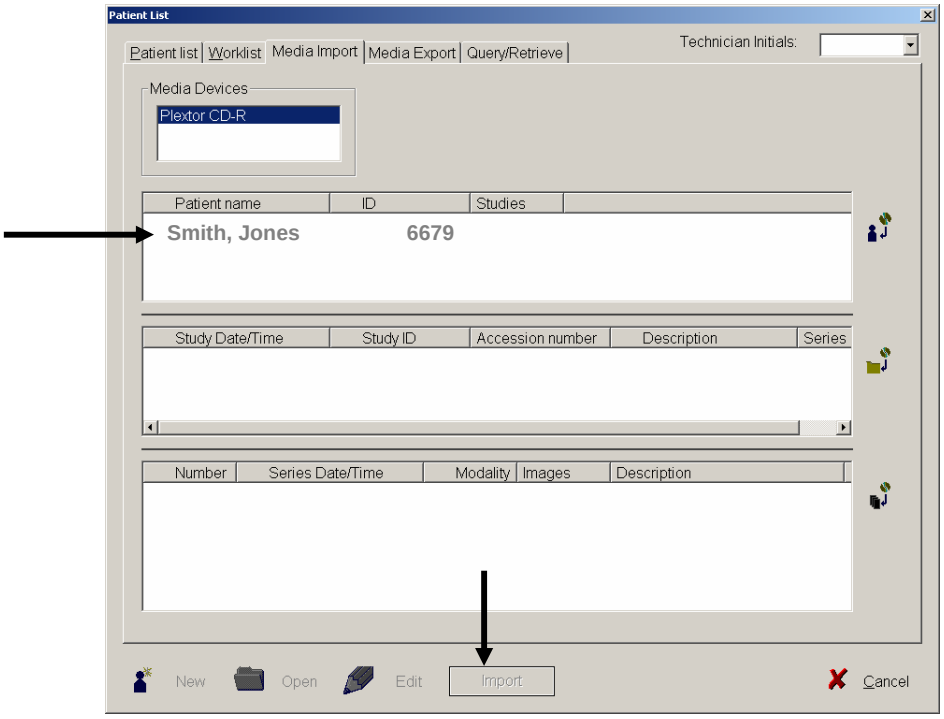
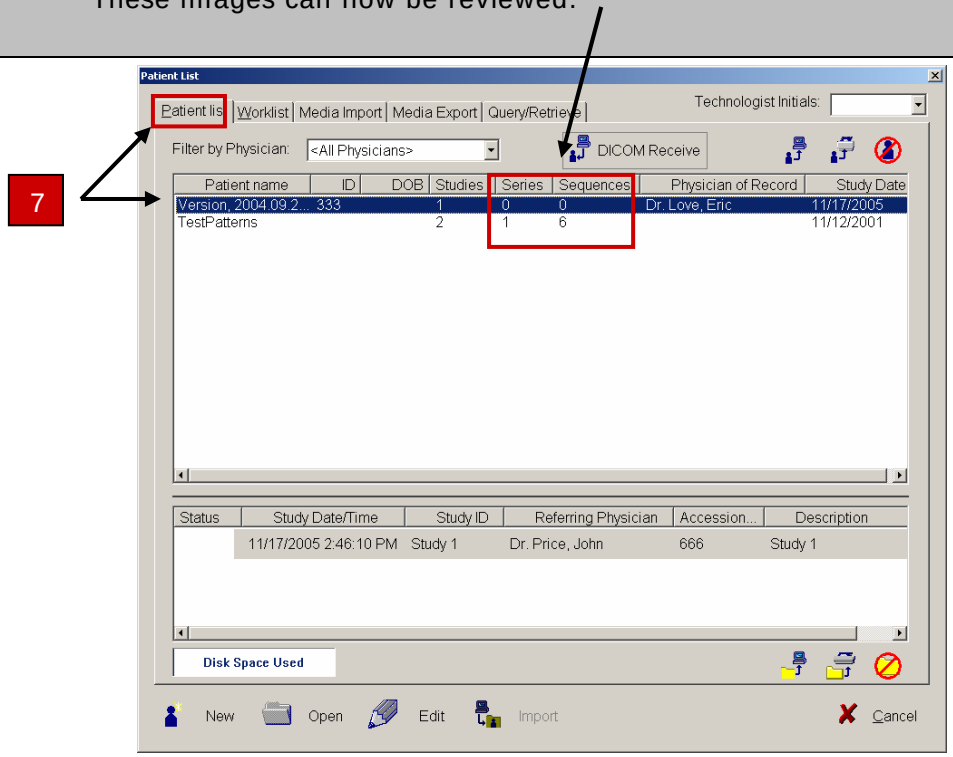


Media Import Results - Patient File Import

7. The DIS will import the patient information and images from the CD.

8. Select the **Patient List** tab. The **Patient List** will now show the recently imported patient.

NOTE: These images can now be reviewed.



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8.9.2 Import Using DICOM Receive

This feature allows the system to receive images from a DICOM device connected by an Ethernet network.

Once the DICOM Receive function is activated, the system will remain in this mode waiting for files.

As images are received, patient information is also imported, and saved to the DIS database. If a matching patient file already exists, the images will be appended to the file. If no patient file exists, the DIS will automatically create a new Patient file or study.

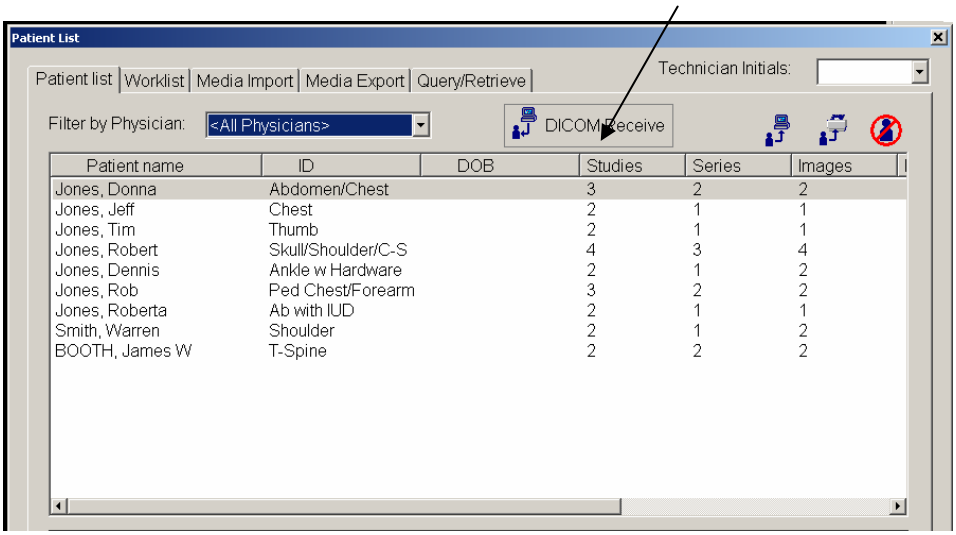
If an imported image already exists in the DIS database, the data is simply discarded; it will not be stored twice.

If an error occurs while the system is importing (database locked, out of disk space, etc.), a ***Failed*** message will be sent to the device attempting to send the image to the DIS.

To use this feature:

1. At the ***Main Image*** screen, click on to open the ***Patient List Screen***.

2. At the top of the ***Patient List*** screen, click on
.



3. The system is now in ***DICOM Receive*** mode. The patient files/images can now be sent from the other DICOM device.

4. The patient file information and images will be received and added to the ***Patient List***.

5. Check on the status of the process to see when the import function is complete (see Chapter 8.10.4 – Status screen).

6. Once a patient file has been added to the ***Patient List***, select the **Patient List** tab and then select the desired patient file for review.

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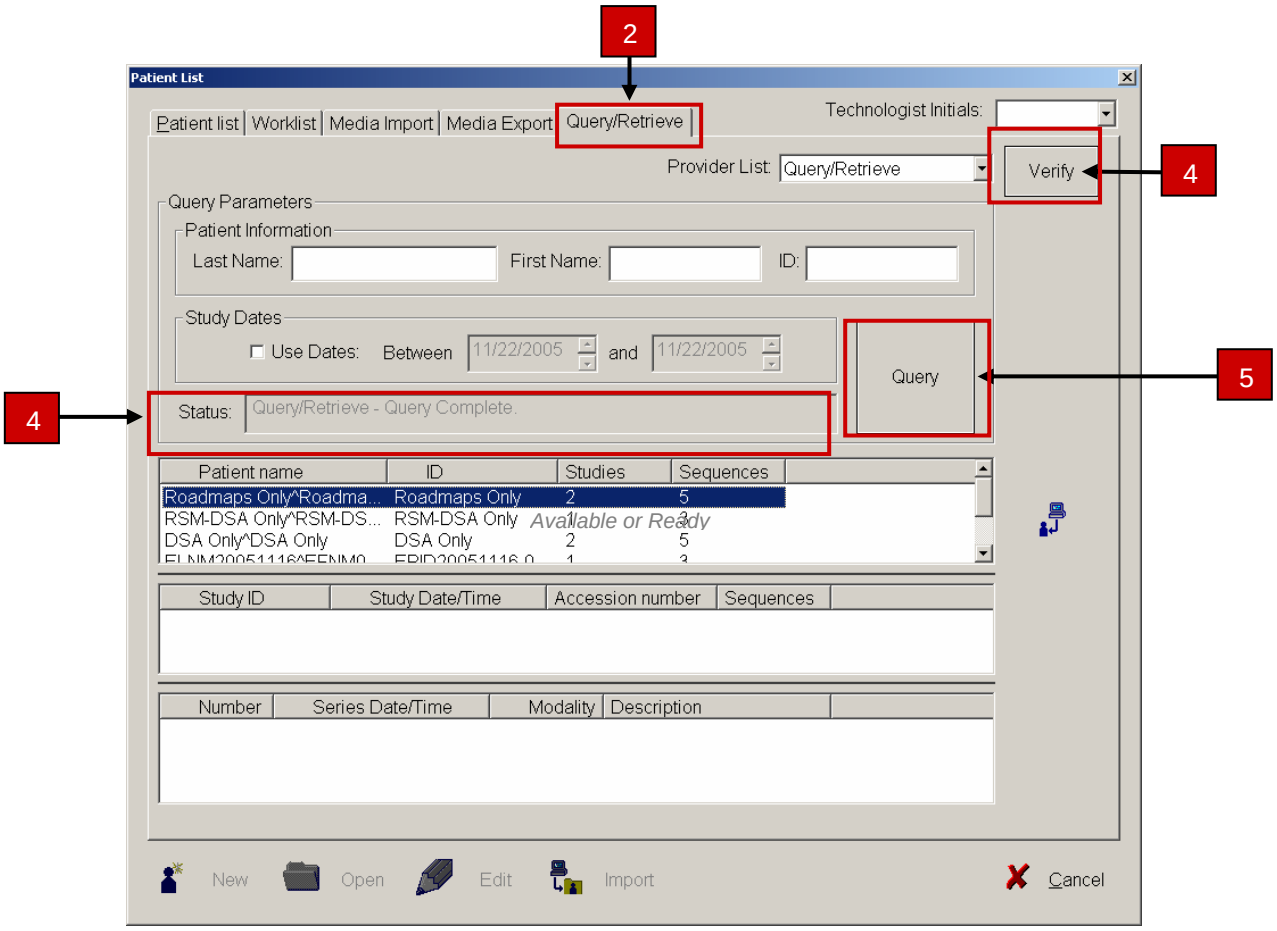
8.9.3 Import Using DICOM Query/Retrieve

This feature allows the system to search DICOM databases for patient information and images that can be imported into the system via the DICOM Retrieve function. The system acts as a DICOM Query/Retrieve Service Class User to perform this function.

1. Click on to display the ***Patient List*** screen.

2. Click on the **Query/Retrieve** tab.



Query/Retrieve Screen

3. Select the desired **Provider** from the **Provider List** drop-down menu.

4. Click on the **Verify** button to verify the status of the network device. The status of the device will be shown in the **Status** box: should be *Available* or *Ready*.

5. Click on the **Query** button. The DIS will then get the names of the files from the selected remote device. The status of this process is shown in the **Status** box.

6. When process is complete, the **Status** box will say ***Query Complete***, and the patient information will be updated in the corresponding panes of this screen.

7. Highlight the desired patient for retrieval.

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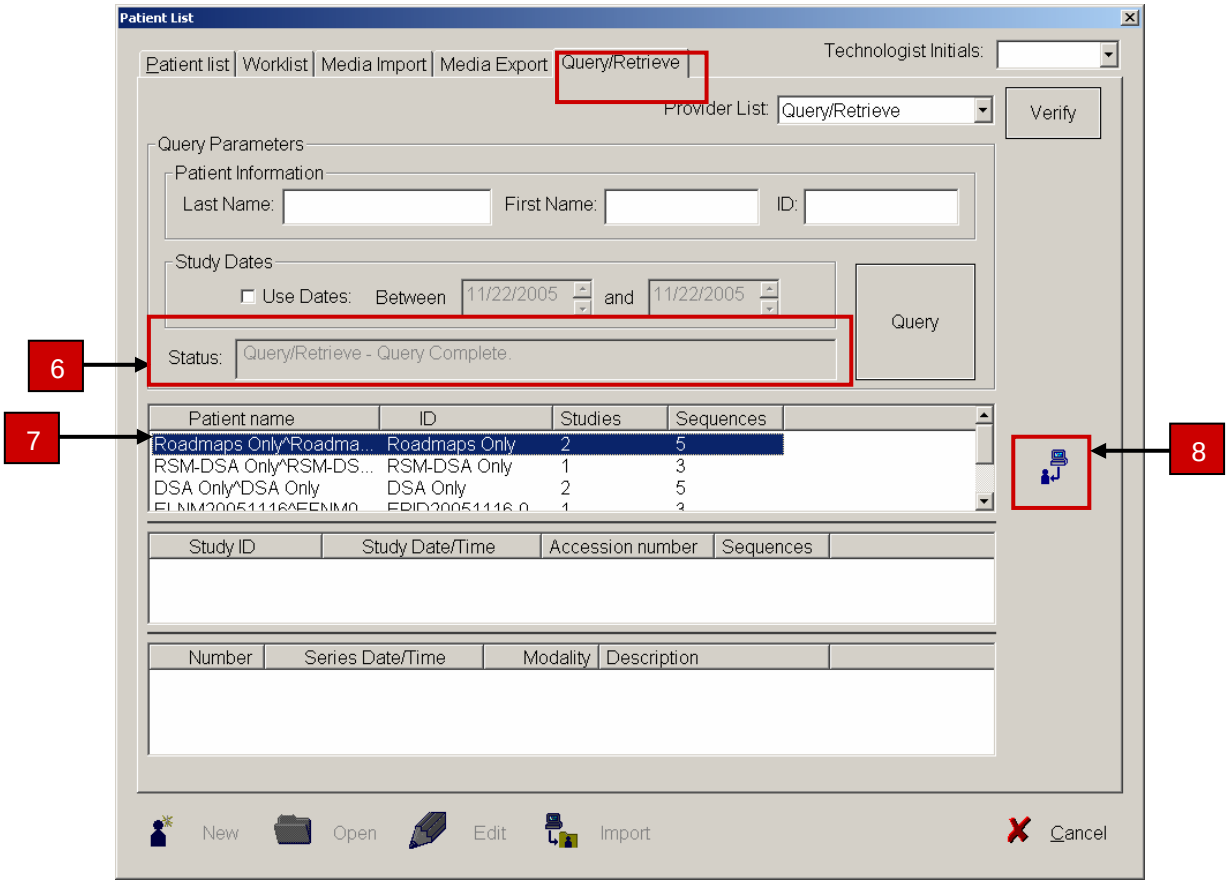
8. Click . When the transfer is complete, the newly retrieved file will be listed in the ***Patient List***. Select the **Patient** List tab to view.



Query/Retrieve Results Screen

To display study information for a selected patient, double-click on the Patient's name. Related studies will display in the Study Window. Similarly, to display specific series, double-click on the study title. The series related to that study would display.

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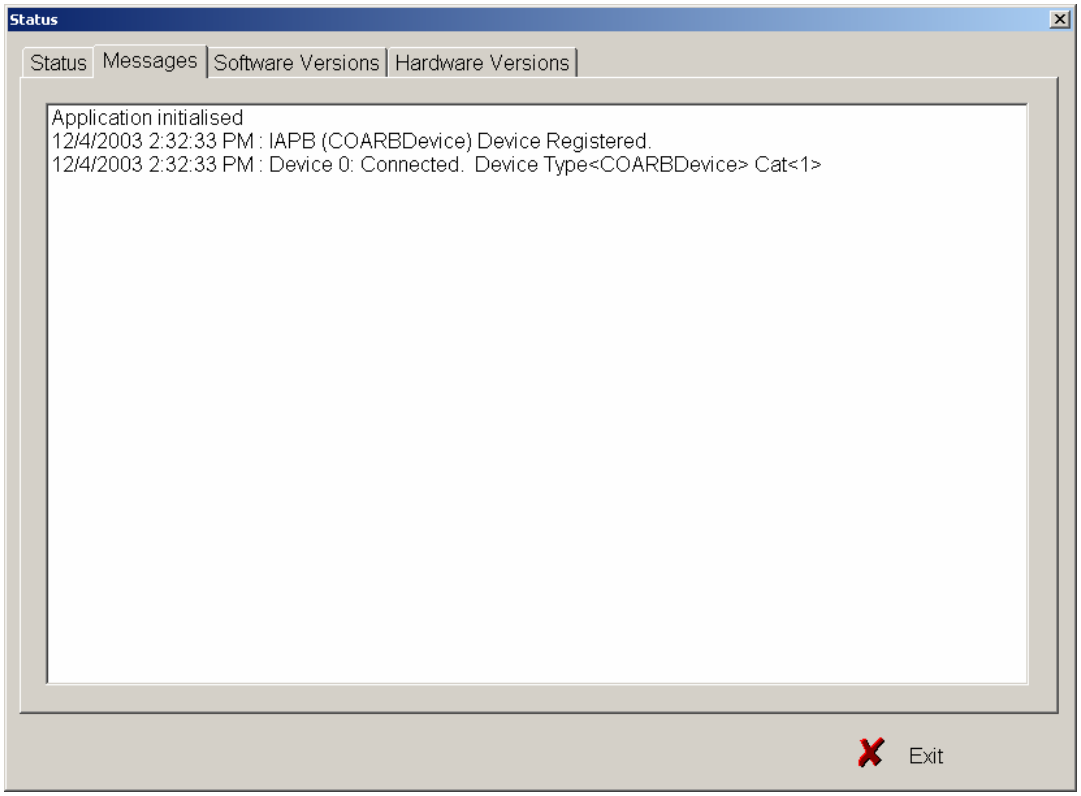
8.9.4 Status Screen

A status screen is available to verify that the operation has been completed successfully or that the import is still in progress.

1. At the top of the ***Main Image*** screen, click

. The ***Status* screen** will display. The Status tab will be visible.

2. At the *Status Dialog* screen, click on the **Messages** tab. The ***Messages*** screen will display.



3. This screen will show the status of the import and is updated with each change.

4. When finished, select **EXIT** to close this window. If import process fails, try again or contact the site network administrator for assistance.

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8.10 EXPORTING FILES

The system can send patient data and images to a remote device using the DICOM standard. Typically, data is sent to a DICOM compliant network device such as a remote PC, a storage server, or media device (CD-RW).

The DIS can be configured to communicate with multiple devices. Each device must be entered using the DIS *Service Applications* mode before files can be exported. Contact your Service Representative if the device to which you want to export is not listed.

Once a patient file is created and images acquired for that patient, there are several opportunities to export patient files/studies/images to a remote device. Each is described in the following sections:

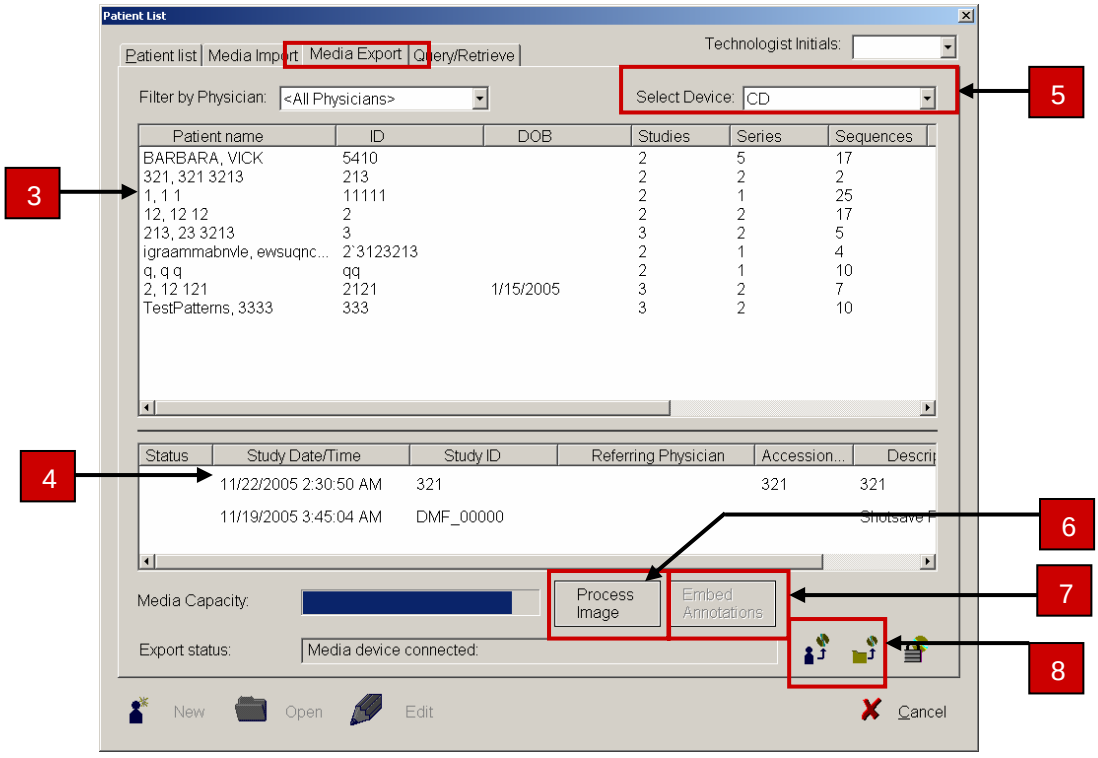
- Export to a DICOM CD
- Auto DICOM Send
- Manual DICOM Send
- Send from Patient List
- Export from Thumbnail Image

8.10.1 Export to DICOM CD

1. At the ***Main Image*** screen, click to open the ***Patient List***.

2. At the ***Patient List*** screen, click on the

tab to open the ***Media Export*** screen.



Media Export Screen

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3. Select the patient file to be exported.
4. Select the study to be exported.
5. From **Select Device** drop-down menu, select device to which you want to export.
6. To include processing features (previously applied to the images, such as Edge, Brightness, Contrast adjustments, etc.) with the exported images, select the **Process Images** button.
7. To include text annotations or pointers with the exported images, select the **Embed Annotations** button.
8. Select either the button to export the entire patient file, or select the button to export the selected study.
9. A transfer job is created and added to the queue.

NOTE: The available capacity for the CD will be updated on the screen. In the Figure shown here, the CD being used is full.

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8.10.2 Auto DICOM Send

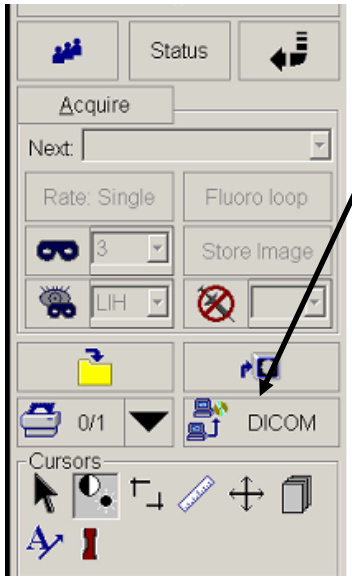
DICOM Send is a function of digitally transferring patient data and images to a DICOM-compliant device.

Auto DICOM Send refers to an *automated* process where each image that is acquired and stored to the system database will **automatically** be sent to the preferred DICOM destination (also configured as a Doctor Preference).

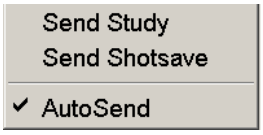
This feature is set as one of the Doctor Preference (see Chapter 4.2 and 4.3 for more information on Doctor Preferences).

Turn this feature ON/OFF for the current patient file by using the following procedure.

NOTE:	Turning on/off the feature this way has no effect on the Doctor Preference setting.



1. At the ***Main Image*** screen, click on the **DICOM** button.
2. A short DICOM sub-menu will display.
3. If AutoSend is active, a check mark (✔) will appear next to AutoSend.



4. To disable the function, click on the text. The check mark will be deleted and the function disabled.
5. To re-activate, simply repeat steps.
6. The patient file will remain open, and images can be acquired normally. See Chapter 8.11.6 and 8.11.7 for information on the status of the exported images.

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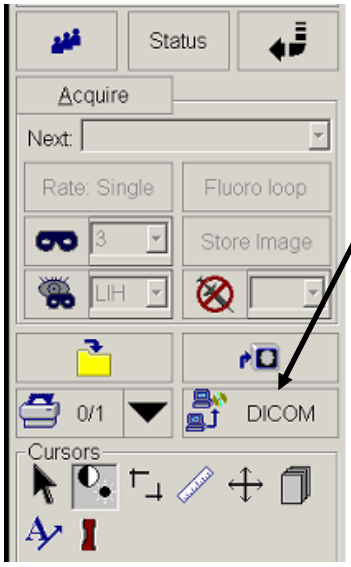
8.10.3 Manual DICOM Send

DICOM Send is a function of digitally transferring patient data and the corresponding images to a DICOM-compliant device.

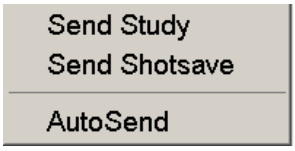
Manual DICOM Send refers to the process of selecting a patient file and images to be sent, as opposed to *Auto DICOM Send* (see Chapter 8.11.2 above).

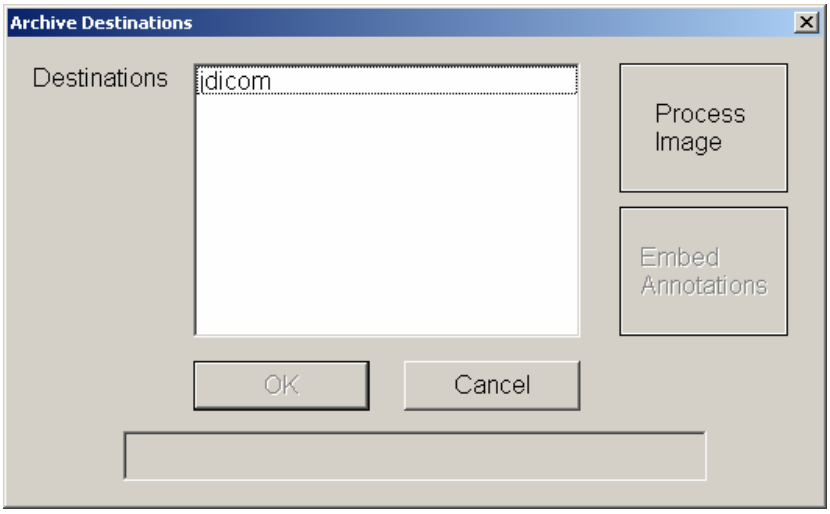
Images will be sent to the preferred DICOM device as configured in Doctor Preferences (see Chapter 4 for more information on Doctor Preferences).

In order to use this function, a patient file with images must be open and displayed on the ***Main Image*** screen.



1. At the *Main Image* screen, click on the **DICOM** button.
2. A short DICOM sub-menu will display.
3. Select either **Send Study** or **Send Shotsave**.
4. The *Archive Destination* screen will be displayed.





Archive Destination Screen

5. Click on the desired **Destination** from list of those available.

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6. To include any processing features previously applied to the images, (such as Edge, Brightness, Contrast adjustments, etc.) with the exported images, select the **Process Image** button.

7. To include any text annotations or pointers with the exported images, select the **Embed Annotations** button.

   NOTE: Embed can only be used in conjunction with processing.

8. Click on the **OK** button to send the images.
   Once the OK button is selected, jobs are added to the Queue and the patient file will be closed.

NOTES: See Chapter 8.11.6 of this section for an explanation of how exported files are queued for exporting.

See Chapter 8.11.7 following here for instructions on how to check the status of the file transfer.

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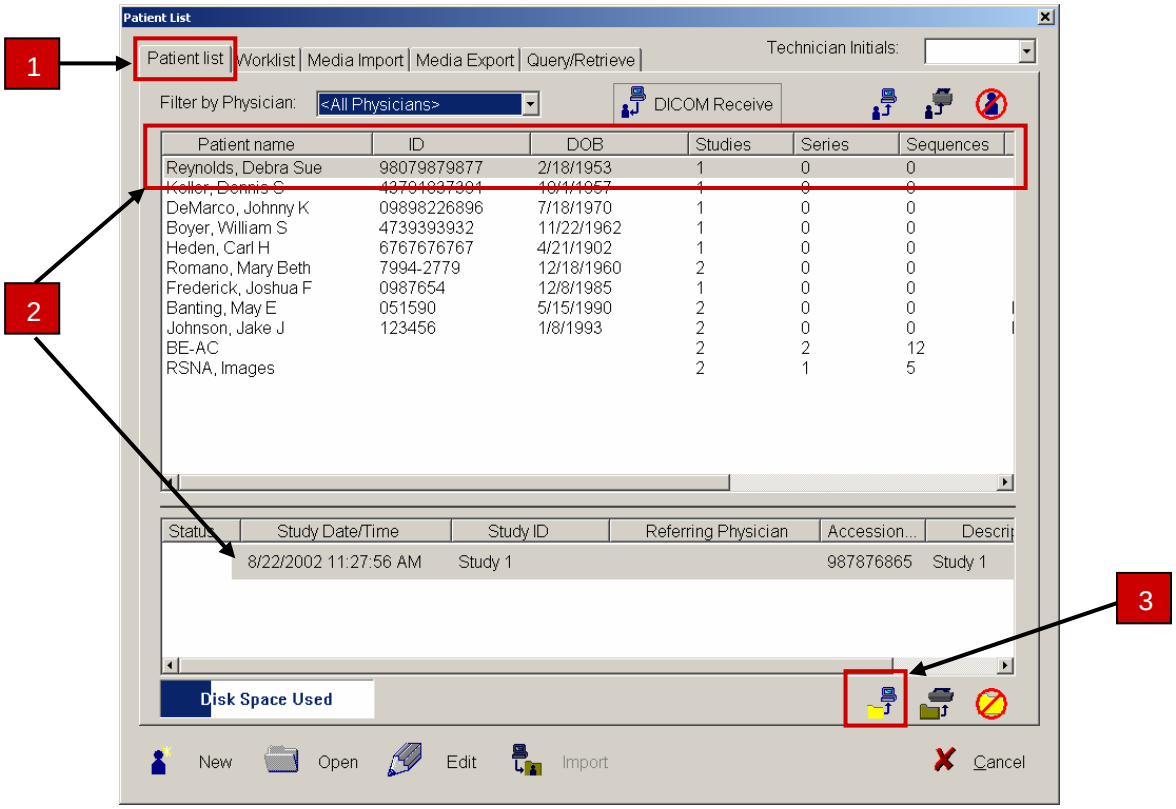
8.10.4 Exporting From Patient List

While at the ***Patient List***, select a specific patient file or study to be exported to a specified DICOM destination.

1. Click on the **Patient List** button to display the ***Patient List*** screen.



2. Highlight the desired patient file or highlight a specific study
3. Click on the desired DICOM Send button.

	Sends entire Patient file to selected DICOM destination.
	Sends specific study to selected DICOM destination.

4. The *Archive Destination* screen will display.

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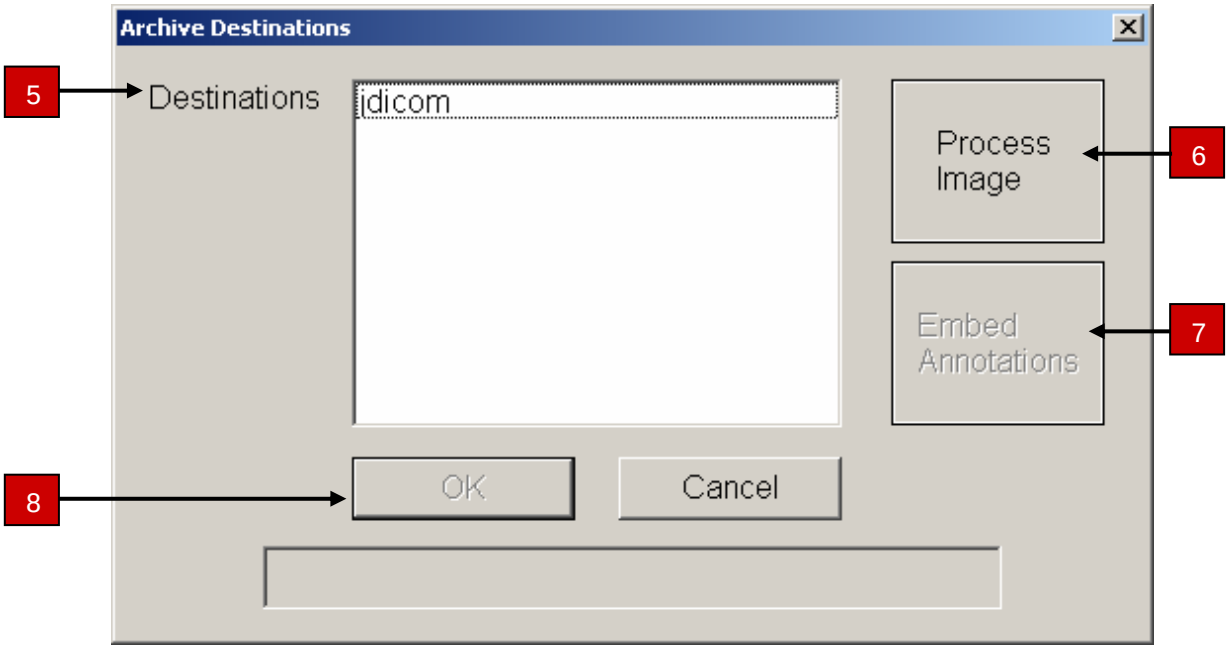

Archive Destination Screen

5. Click on the preferred **Destination** from list at this screen.
6. To include processing features previously applied to the images, (such as Edge, Brightness, Contrast adjustments, etc.) with the exported images, select the **Process Image** button.
7. To include text annotations or pointers with the exported images, select the **Embed Annotations** button.
8. Click on the **OK** button to export the images.

NOTES:	See Chapter 8.11.6 for an explanation of how exported files are queued for exporting. See Chapter 8.11.7 for instructions on how to check the status of the file transfer.

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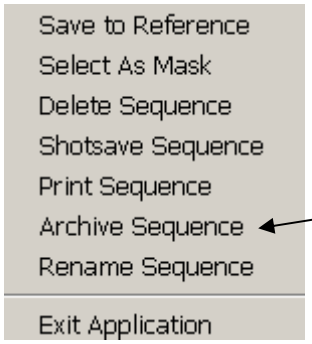
8.10.5 Exporting from Thumbnail

Image sequences can be sent to a DICOM destination directly from an Image Thumbnail.

In order to perform this function, a patient file with images must be open at the ***Main Image*** screen.

1. Left-click on the Thumbnail representing the sequence you want to export. A box will appear around the Thumbnail indicating it is selected.

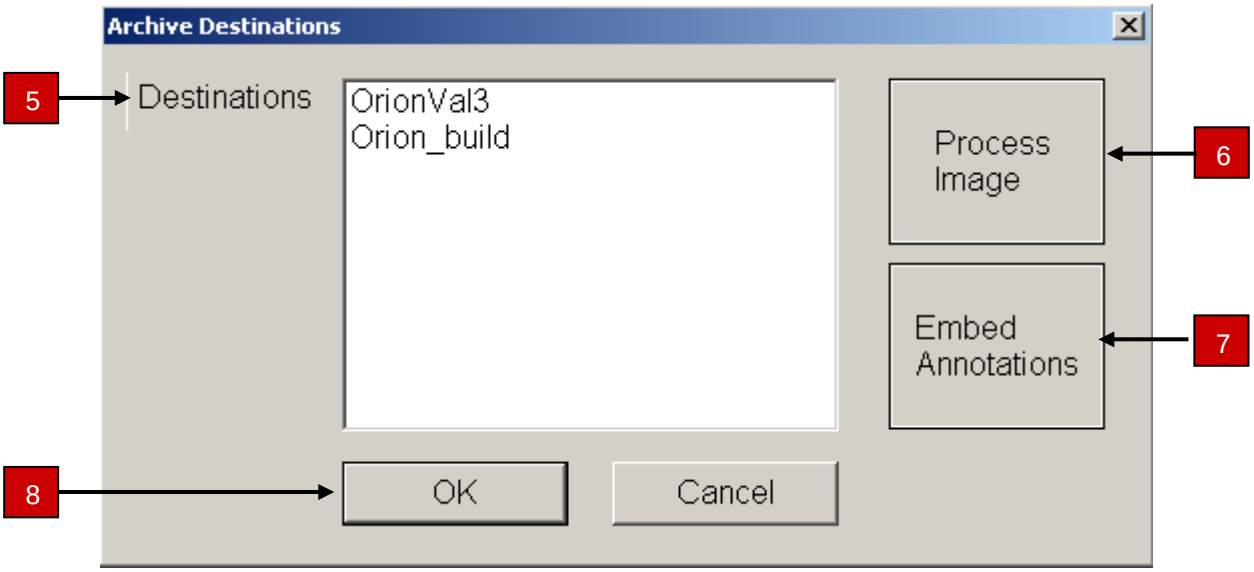
2. Right-click on the same Thumbnail to open the Thumbnail sub-menu.



Thumbnail Sub-Menu

3. Click on the **Archive Sequence** option.

4. The *Archive Destination* screen will appear showing all possible destinations.



5. Click on the desired **Destination** from list at this screen.

6. To include processing features previously applied to the images, (such as Edge, Brightness, Contrast adjustments, etc.) with the exported images, select the **Process Image** button if Process image is active.

7. To include text annotations or pointers with the exported images, select the **Embed Annotations** button.

8. Click **OK** to export the images.

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NOTES:	See Chapter 8.11.6 following here for an explanation of how exported files are queued for sending. See Chapter 8.11.7 following here for instructions on how to check the status of the file export.

8.10.6 Queue Process for Exporting Files

Each export request is handled separately. The system takes each Export Request in the order the request was made and puts them in a Queue (an ordered *list*).

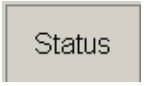
When an Export Request comes to the head of the Queue a temporary folder is created on the hard drive that contains all the necessary DICOM information including: the image data, the patient data, and the DICOM XA modality type. This helps protect the original file/image data.

As images are written to the temporary folder, status messages indicating the progress are shown on the *Status* screen. When all of the data for that patient file has been written to the temporary folder the contents of that folder is then exported to the selected remote DICOM device.

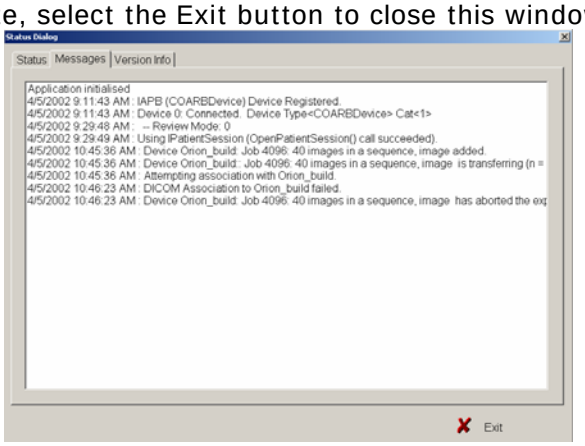
Again, status messages indicating the progress are shown on the *Status* screen.
If this transfer fails, the Export request is labeled **Aborted** and moved to a separate ***Inactive*** queue. The system stops trying to send the aborted file and moves on to the next Export request in the queue.

8.10.7 Transfer Status

A ***Status Messages*** screen is available from the ***Main Image*** screen.

1. At the ***Main Image*** screen, click 

. The *Status* screen will display.
2. At the *Status* screen, click on the **Messages** tab. The *Messages* screen will display.
3. This screen will show the exact status of the Import and is updated with each change.
4. When finished, select **EXIT** to close this window. If Import process fails, try again or contact the site network administrator for assistance.
5. The Messages screen will show the exact status of the current transfer operation and is updated with each change.
6. When transfer is complete, select the Exit button to close this window.


Status Dialog
Status
Messages
Version Info
Application initialised
4/5/2002 9:11:43 AM : IAPB (COARBDevice) Device Registered.
4/5/2002 9:11:43 AM : Device 0: Connected. Device Type<COARBDevice> Cat<1>
4/5/2002 9:29:48 AM : -- Review Mode: 0
4/5/2002 9:29:49 AM : Using IPatientSession (OpenPatientSession() call succeeded).
4/5/2002 10:45:36 AM : Device Orion_build: Job 4096: 40 images in a sequence, image added.
4/5/2002 10:45:36 AM : Device Orion_build: Job 4096: 40 images in a sequence, image is transferring (n =
4/5/2002 10:45:36 AM : Attempting association with Orion_build.
4/5/2002 10:46:23 AM : DICOM Association to Orion_build failed.
4/5/2002 10:46:23 AM : Device Orion_build: Job 4096: 40 images in a sequence, image has aborted the exp
Exit

Message Screen

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8.11 Windows Image Formatting

Images on the DIS can also be shared between non-DICOM computers (for use in a web page, Word® document or other Windows® application, etc) or burned on a CD using the Roxio CD Creator® software provided with your system (see next section for instructions).

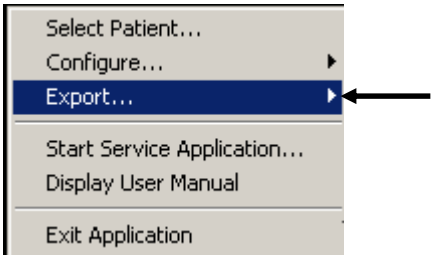
Images can be exported in a variety of formats such as BMP, JPEG or AVI format.

8.11.1 BMP (Bitmap)

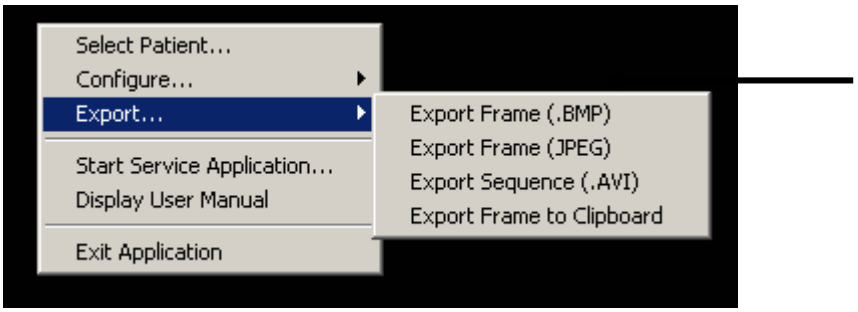
BMP is the standard bit-mapped graphics format used in the Windows environment. By convention, graphics files in the BMP format end with a *.BMP* extension.

To select this feature for a specific image frame (not a sequence):

1. Right-click the mouse while the cursor is over the image portion of the screen. The ***Right-click*** menu will display.



2. Select **Export**. The *Export* sub-menu will display.



3. Select **Export Frame (.BMP)**.
4. A new screen appears, called, *File Save As*.
5. At this new screen, select a directory folder where you want to save the file, enter a filename, then click the **SAVE** button.

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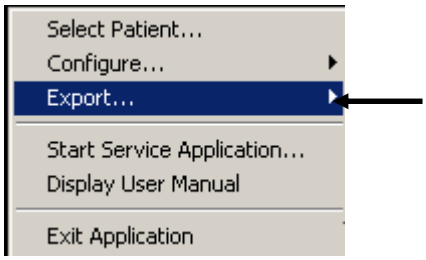
8.11.2 JPEG

Short for ***J**oint **P**hotographic **E**xperts **G**roup,* the JPEG file format is a compressed format.

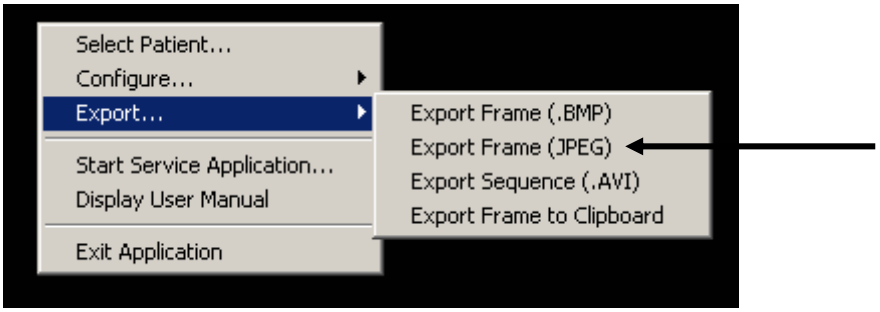
Although it can reduce files sizes to about 5% of their normal size, some detail is lost in the compression.

To select this feature for a specific image frame (not a sequence):

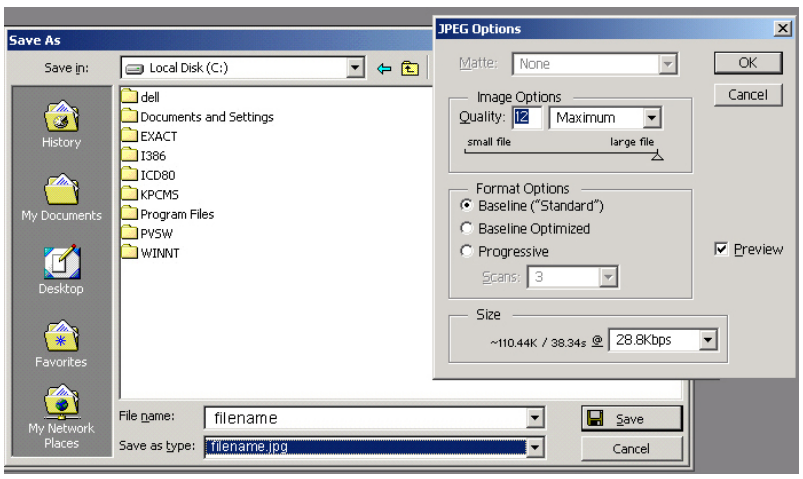
1. Right-click the mouse while the cursor is over the image portion of the screen. The ***Right-click*** menu will display.



2. Select **Export**. The *Export* sub-menu will display.



3. Select **Export Frame (JPEG)**.
4. A new screen appears, called, *File Save As*.
5. At this new screen, select a Directory Folder where you want to save the file, enter a Filename, then click the **SAVE** button.



NOTE:
The JPEG Options screen is shown for your reference only.

This screen will not show as you are saving; however, the file will get saved as a Baseline (Standard) format with a maximum image quality level of 12.

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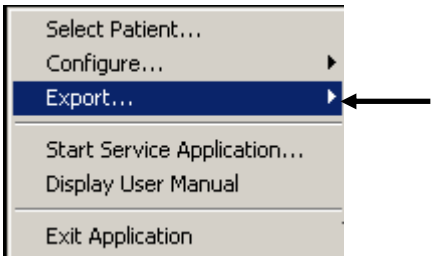
8.11.3 Export Sequence in AVI Format

The AVI (Audio Video Interleave) format is a common format on PCs, and comes with the Windows® operating system.

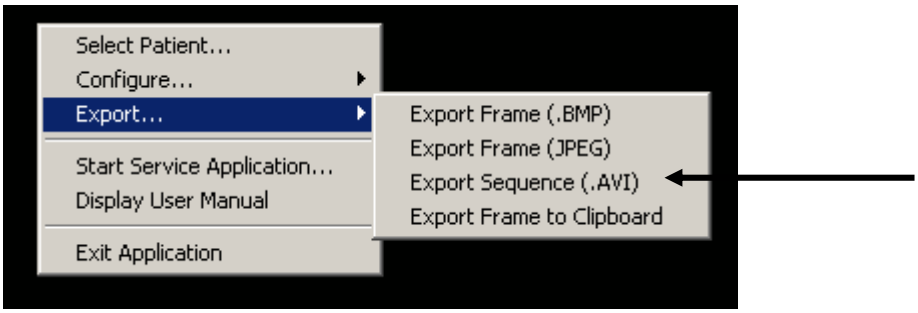
The format is used for video formatting. It captures a series of images for dynamic replay.

To select this feature for the current sequence of images:

1. Right-click the mouse while the cursor is over the image portion of the screen. The ***Right-click*** menu will display.



2. Select **Export**. The *Export* sub-menu will display.



3. Select **Export Sequence (.AVI)**.

4. A new screen appears called, ***Movie Export*** (see Figure below). Use this screen to customize the image sequence being created.

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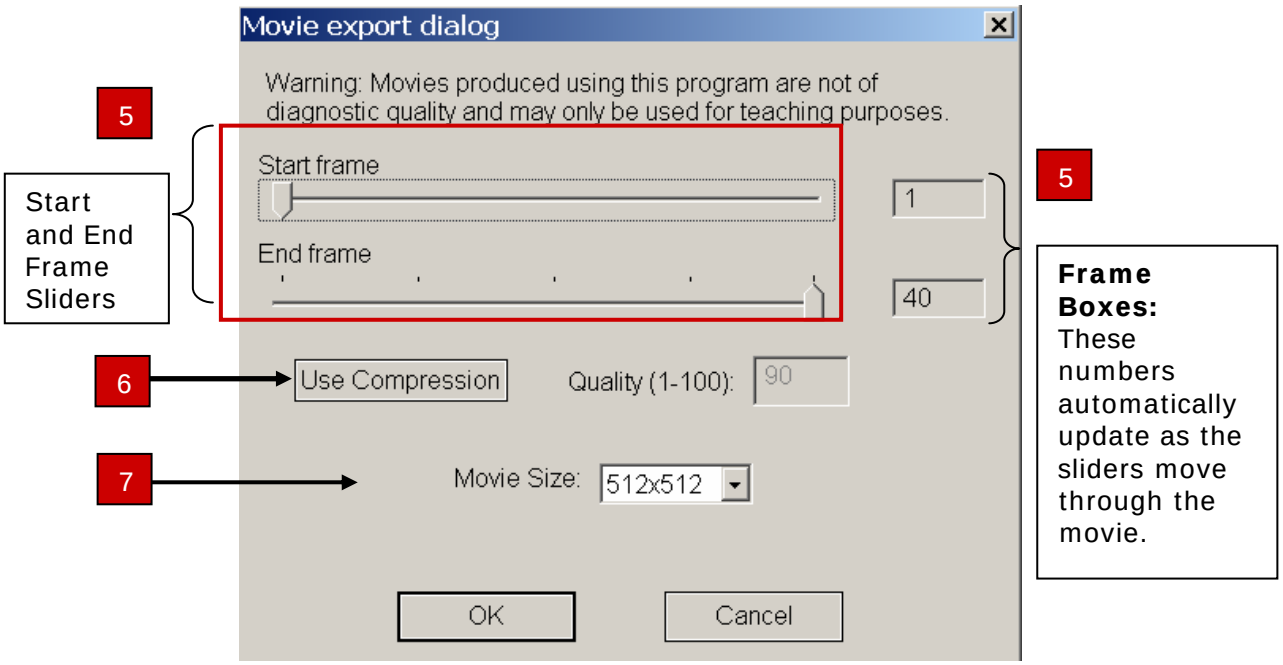


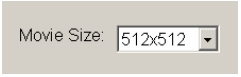
5. **FRAME SLIDERS**
Use the **Start Frame** and **End Frame sliders** to quickly select a starting frame and end frame for the sequence to be exported.

- For more precise settings, enter the exact Frame number in the **Frame box** for the starting and ending frames of sequence to be exported.

6. **COMPRESSION:**
Compress the sequence of images or leave them uncompressed. Compression reduces the overall disk space needed to store the sequence but is accomplished by sacrificing some image quality.

- To compress the image click the Use Compression button, then use the keyboard to enter a compression percentage in the box.
- Range is 1-100.
- The percentage indicates the amount of compression. Thus if 90% is entered, the file is compressed by 90%, sacrificing a lot of image quality but getting the file down to a very small size. Alternately, entering 10% will only compress the file by 10% and save much of the image quality.
- The *proper* amount of compression depends on how big the sequence of images is and the quality of the PC that will be used for viewing the sequence.

7. **MOVIE SIZE**
Select the **Movie Size** using the drop-down menu.



8. Click the **OK** button to save the settings and create the selected sequence of images for export. The Movie Export setting screen disappears, and a new screen appears (see Figure below).

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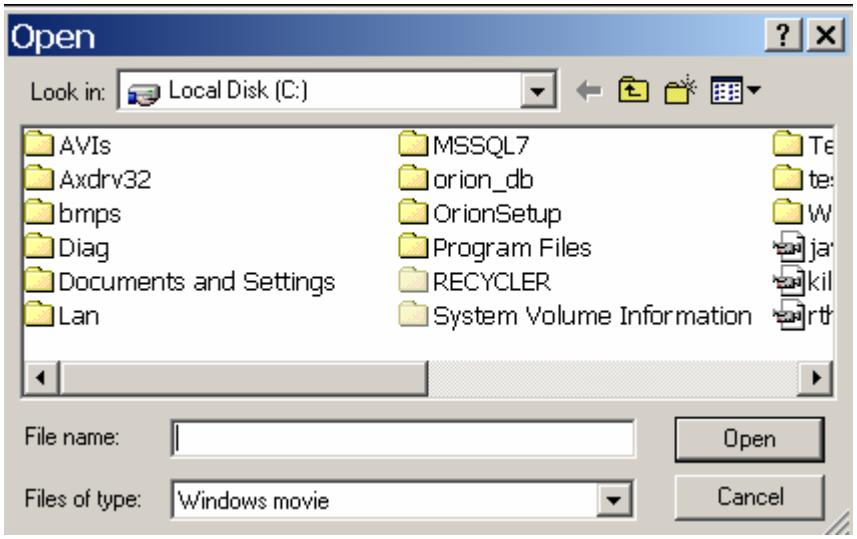
9. Select the desired location to which to export the image sequence, and then click the **OPEN** button. The file will be saved to that location, this small window will close, and the system will return to the ***Main Image*** display.



AVI Export Location Screen

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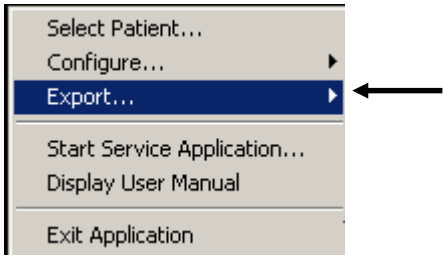
8.11.4 Export Frame to Clipboard

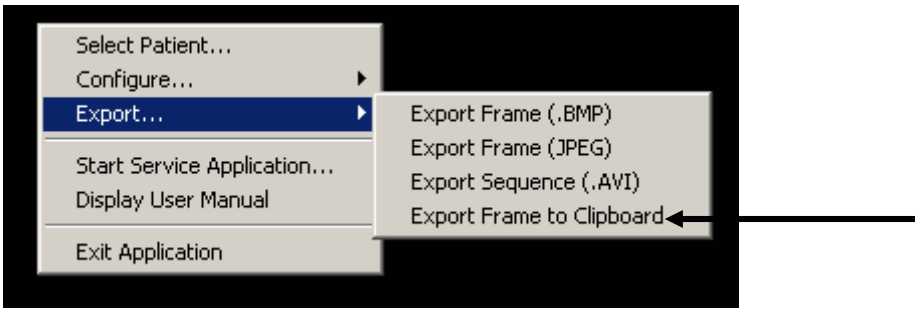
This feature allows the current image to be exported to the clipboard (temporary storage used in Windows® systems). The image can then be pasted into an existing word document or HTML file.

To select this feature for a specific image frame (not a sequence):

1. Right-click the mouse while the cursor is over the image portion of the screen. The ***Right-click*** menu will display.



2. Select **Export**. The *Export* sub-menu will display.



3. Select **Export Frame to Clipboard**.

4. The image is saved on the clipboard of the system and can be pasted into another Windows® type document or HTML file open on the system.

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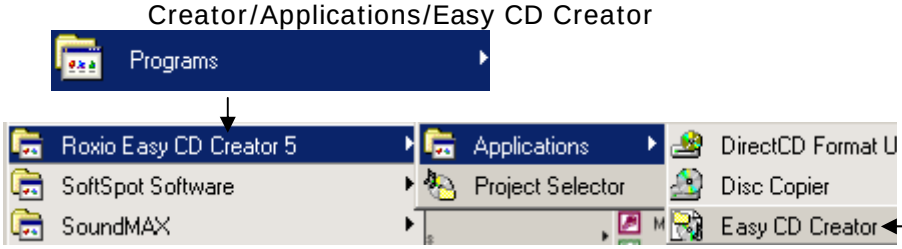
8.12 Creating CDs

One of the accessories provided with your system is the ***Roxio Easy CD Creator ®***. Use this software to quickly copy images file from your hard drive directly to CD.

Follow these steps to burn CD's using Roxio CD Creator:

1. Place a blank CD-R or CD-RW in the CD recorder tray.
2. Click Start on your desktop.
3. Select Programs/Roxio Easy CD Creator/Applications/Easy CD Creator



4. Click Easy CD Creator and the *Select a Project* screen will display.

5. Position the cursor over “Make a Data CD”

This screen will go “live” and the screen will change displaying the various data CD options available.

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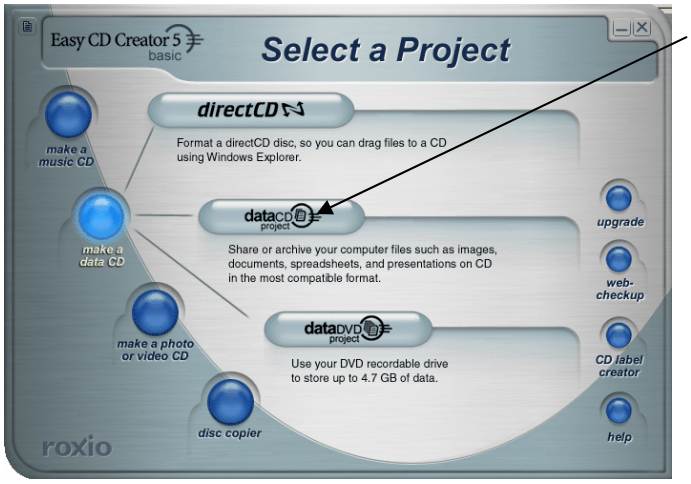
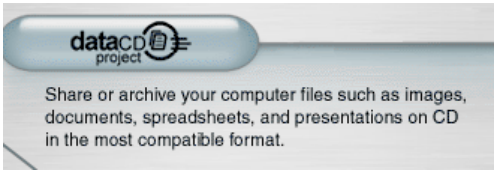
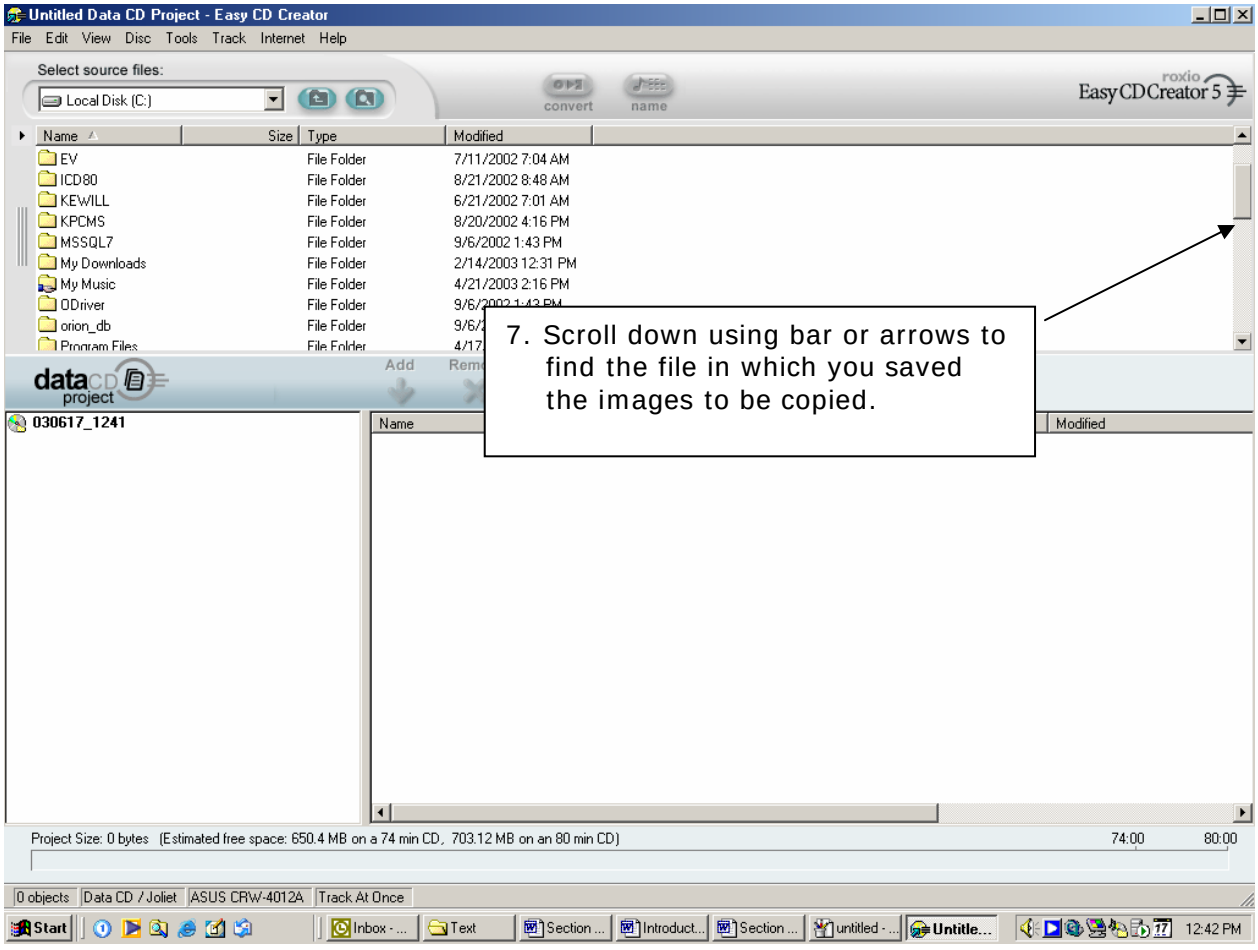

Easy CD Creator 5 basic
Select a Project
directCD
Format a directCD disc, so you can drag files to a CD using Windows Explorer.
make a music CD
make a data CD
dataCD project
Share or archive your computer files such as images, documents, spreadsheets, and presentations on CD in the most compatible format.
upgrade
web-checkup
make a photo or video CD
dataDVD project
Use your DVD recordable drive to store up to 4.7 GB of data.
CD label creator
disc copier
help
roxio

6. CLICK DATA CD PROJECT IN THE CENTER OF THE SCREEN.


dataCD project
Share or archive your computer files such as images, documents, spreadsheets, and presentations on CD in the most compatible format.

A screen will display from which you can select files to be copied.



7. Scroll down using bar or arrows to find the file in which you saved the images to be copied.

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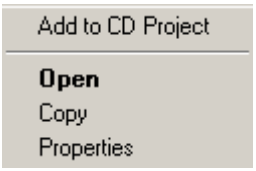
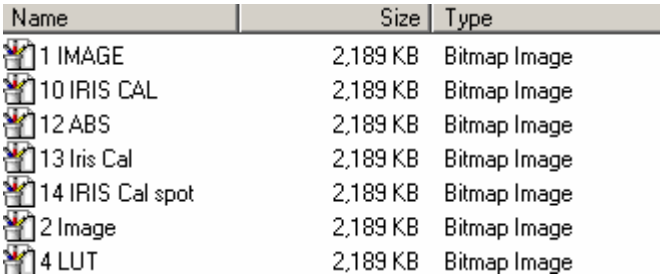
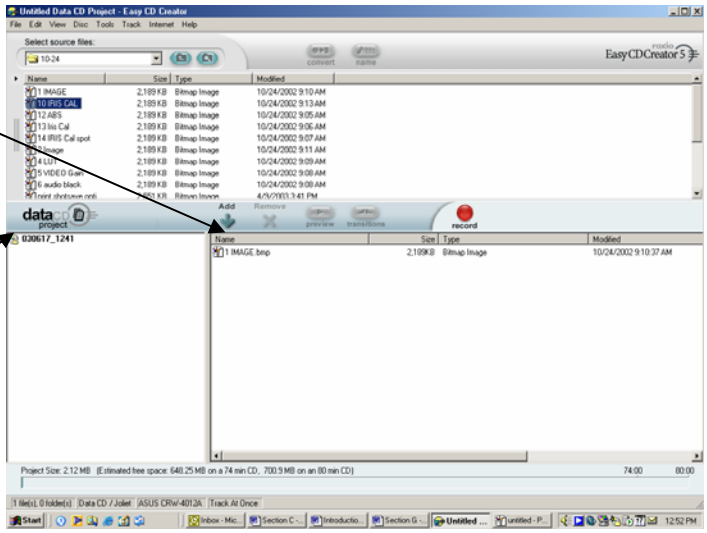
8. Position the cursor arrow over the first image that you want to copy and right click. A menu will display.



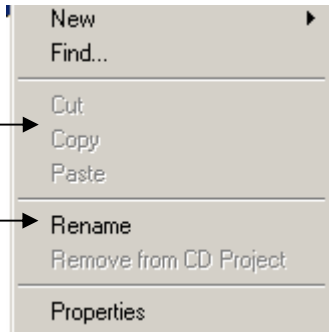

Name
Size
Type
1 IMAGE 2,189 KB Bitmap Image
10 IRIS CAL 2,189 KB Bitmap Image
12 ABS 2,189 KB Bitmap Image
13 Iris Cal 2,189 KB Bitmap Image
14 IRIS Cal spot 2,189 KB Bitmap Image
2 Image 2,189 KB Bitmap Image
4 LUT 2,189 KB Bitmap Image

9. Click on Add to CD Project. The selected image will appear in the window below the listing



To change the title of the CD, position the cursor over the default title box.

Right Click. A sub-menu will display.



Select Rename and the default name becomes “live”. Type the name you wish to use over the existing name.

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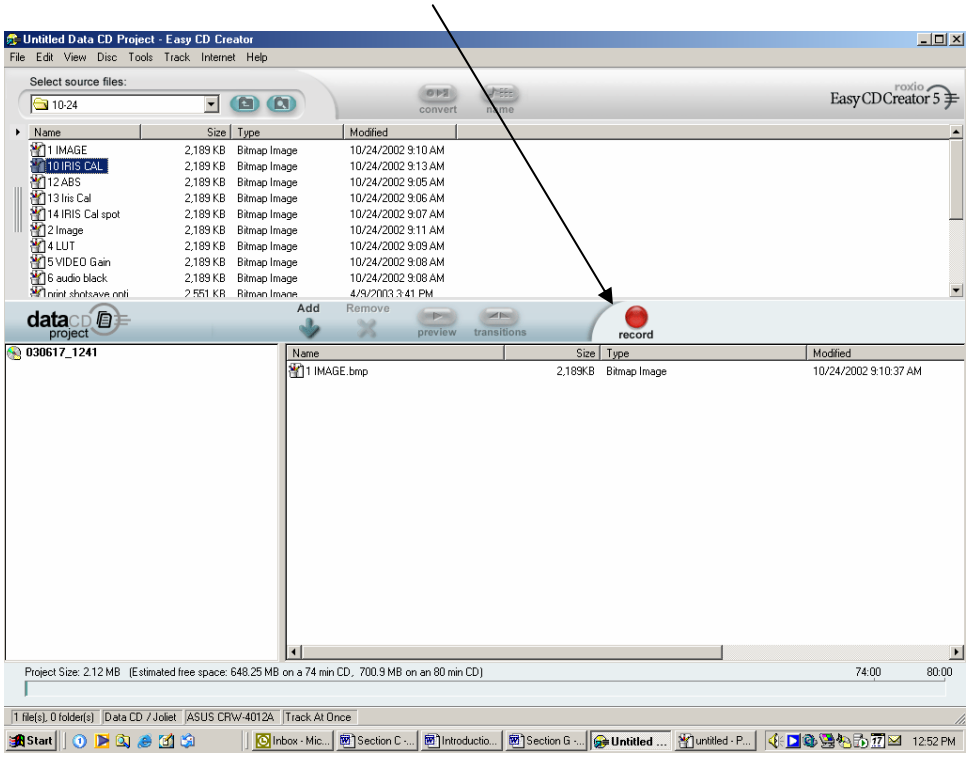
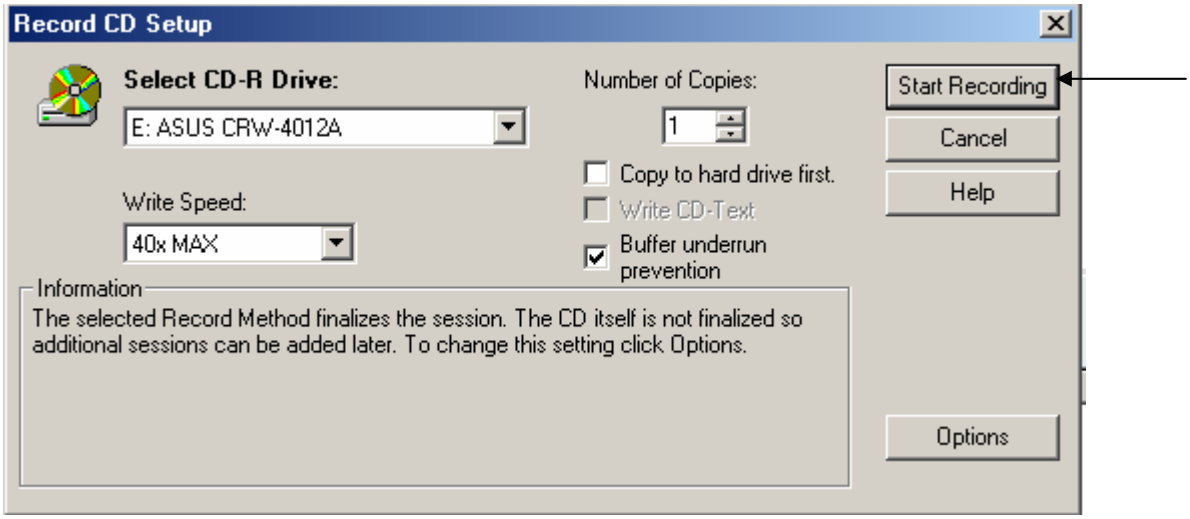
10. Once all of the files that you want to copy have been added to the list, you are ready to record.

Click the

button.


Untitled Data CD Project - Easy CD Creator
File Edit View Disc Tools Track Internet Help
Select source files:
10-24
convert
name
Easy CD Creator 5
Name Size Type Modified
1 IMAGE 2,189 KB Bitmap Image 10/24/2002 9:10 AM
10 IRIS CAL 2,189 KB Bitmap Image 10/24/2002 9:13 AM
12 ABS 2,189 KB Bitmap Image 10/24/2002 9:05 AM
13 Iris Cal 2,189 KB Bitmap Image 10/24/2002 9:06 AM
14 IRIS Cal spot 2,189 KB Bitmap Image 10/24/2002 9:07 AM
2 Image 2,189 KB Bitmap Image 10/24/2002 9:11 AM
4 LUT 2,189 KB Bitmap Image 10/24/2002 9:09 AM
5 VIDEO Gain 2,189 KB Bitmap Image 10/24/2002 9:08 AM
6 audio black 2,189 KB Bitmap Image 10/24/2002 9:08 AM
Add
Remove
preview
transitions
record
030617_1241
Name Size Type Modified
1 IMAGE.bmp 2,189KB Bitmap Image 10/24/2002 9:10:37 AM
Project Size: 2.12 MB (Estimated free space: 648.25 MB on a 74 min CD, 700.9 MB on an 80 min CD)
74:00
80:00
1 file(s), 0 folder(s)
Data CD / Joliet
ASUS CRW-4012A
Track At Once
Start
12:52 PM

11. The Record CD Setup screen will display. Make appropriate selections and then click *Start Recording*.



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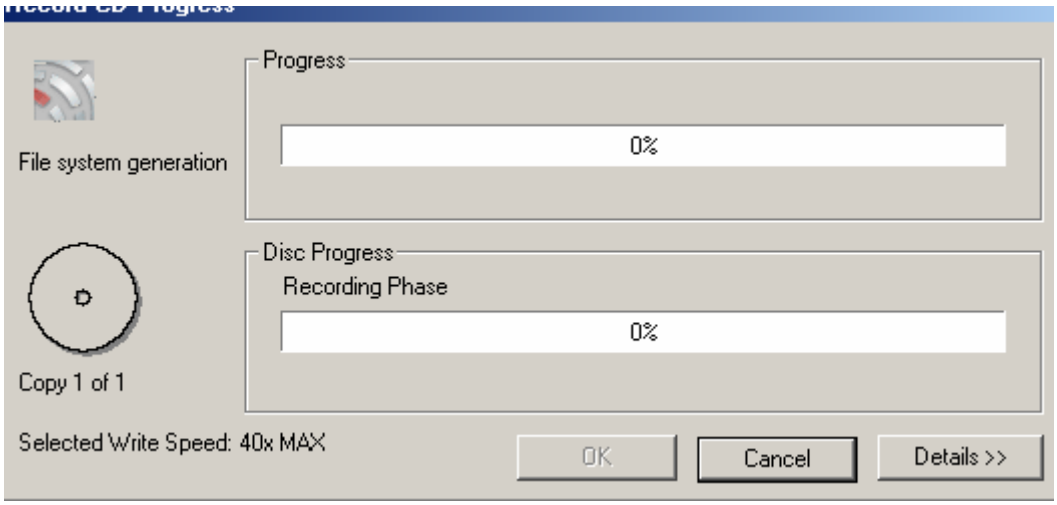
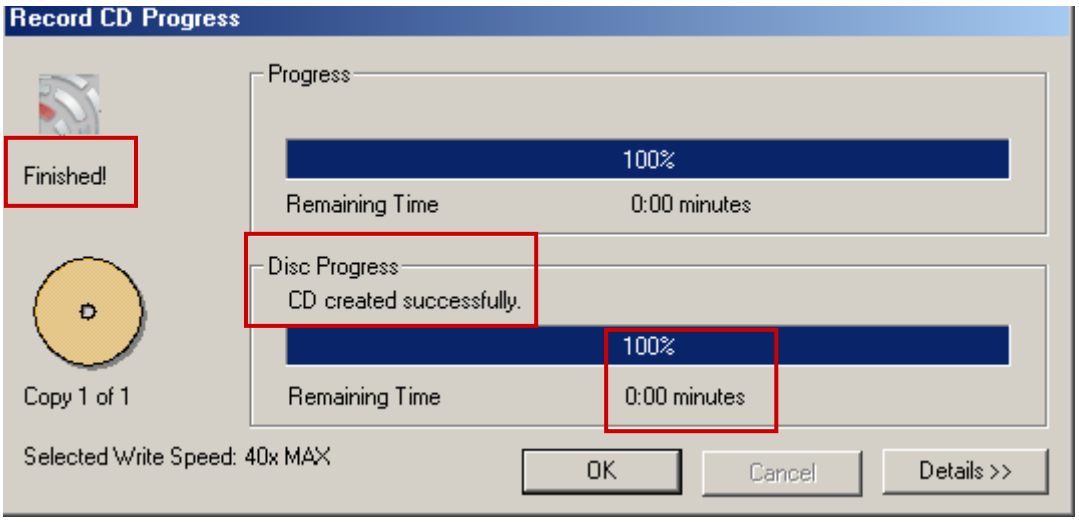
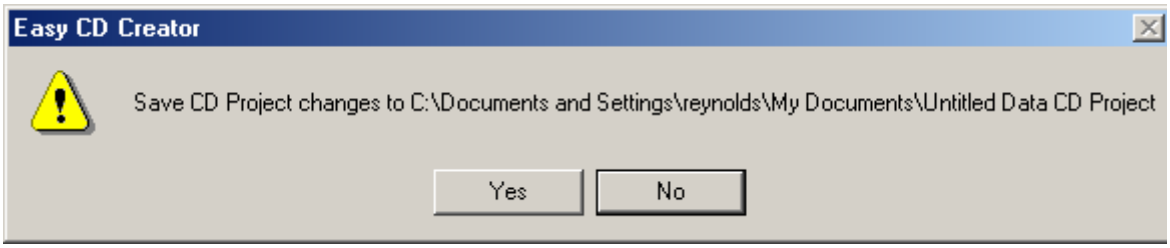
12. Your CD will begin to record. Do not touch any buttons during this process.



13. There are several indicators to indicate when the process is complete. The screen will read *"Finished," "100%,"* and *"0:00 minutes"* of remaining time and *"CD created successfully."*
Now, Click *OK* to *Close* the window



14. You will then have an opportunity to save this project to a folder for future use. It will allow additional CD burns without preparation of some of the earlier steps. To save files, click Yes. Otherwise, click No to close the program.


Easy CD Creator
Save CD Project changes to C:\Documents and Settings\reynolds\My Documents\Untitled Data CD Project
Yes
No

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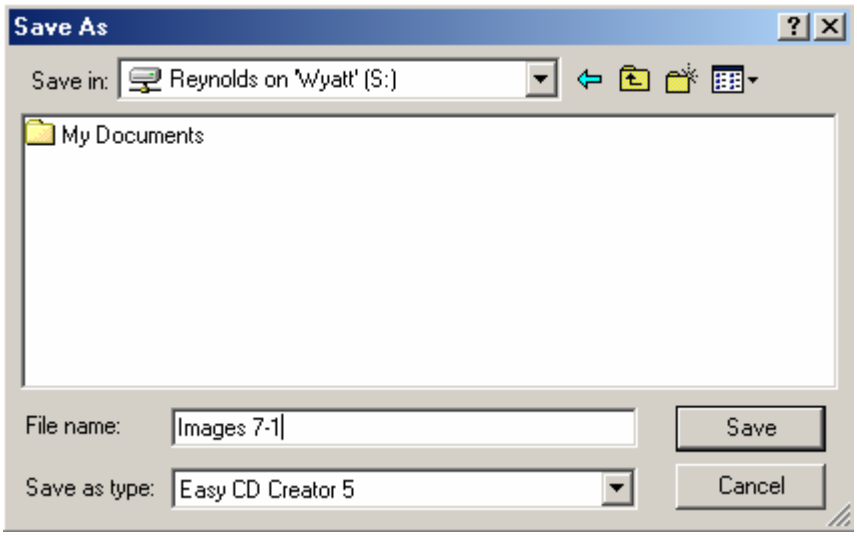
8.12.1 Saving Project

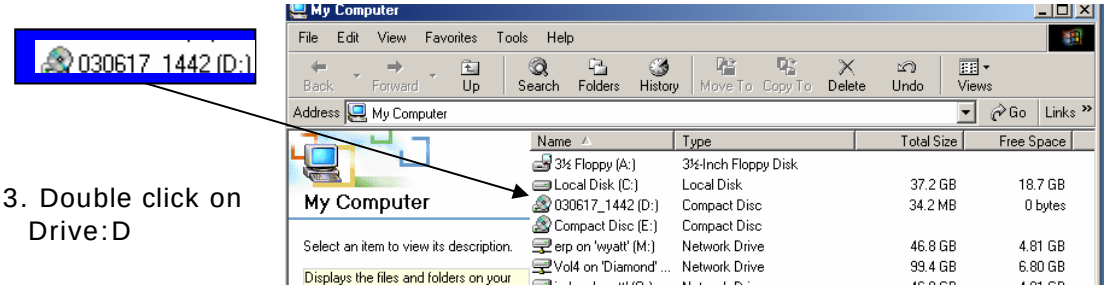
If you clicked Yes indicating that the project is to be saved, the Save As window will display. Select the location that you want to use to store the file, name the file and then click Save.



8.12.2 Viewing the CD

Once the CD has been created, remove it from the CD Recorder tray and place into the CD player tray. It is a good idea to check to make sure all the files were successfully recorded.

1. Double click on your desktop.
2. The Files and folders on your computer display in the My Computer window.


030617_1442 (D:)
My Computer
File Edit View Favorites Tools Help
Back Forward Up Search Folders History Move To Copy To Delete Undo Views
Address My Computer
Go Links
Name Type Total Size Free Space
3½ Floppy (A:) 3½-Inch Floppy Disk
Local Disk (C:) Local Disk 37.2 GB 18.7 GB
030617_1442 (D:) Compact Disc 34.2 MB 0 bytes
Compact Disc (E:) Compact Disc
erp on 'wyatt' (M:) Network Drive 46.8 GB 4.81 GB
Vol4 on 'Diamond' ... Network Drive 99.4 GB 6.80 GB
Select an item to view its description.
Displays the files and folders on your

3. Double click on Drive:D

The CD should contain all of the selected files to be copied in the CD project window.

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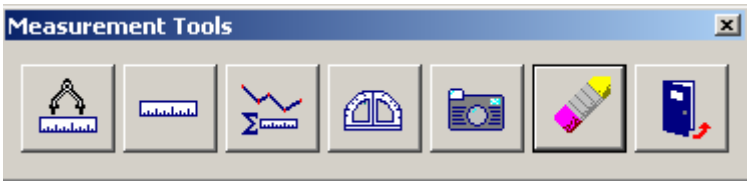
9.1 Measurement Functions

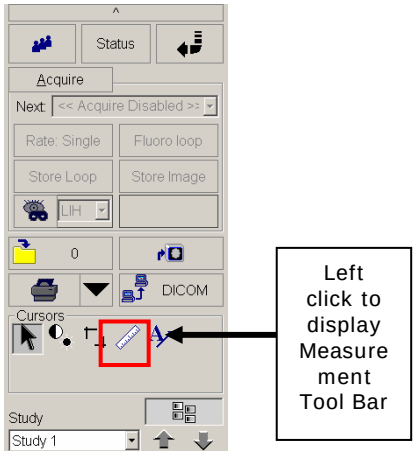
The DIS offers a selection of measurement tools that can be applied to an image and used for reference. Please note that these measurements are approximate and should be used for reference estimate only. Also, in order to get the most accurate measurements, calibration must be done prior to the application of a measurement.

CAUTION: Do not drag the measurement tool bar in to the main image area when setting up any measurement function.

In order to access this feature, a patient file must be open for review.

1. To access, click on in cursor tool bar.
2. The Measurement tool bar will display.





Each button will activate a specific measurement tool. Refer to individual sections for details on using each tool.

Length, Distance, Angular and Calibration functions can be done simultaneously.

WARNING: The Eraser button can be used at any time the Measurement Tool Bar is active and there are measurements on the screen but it will cause all measurements indicated on the screen to be deleted.

Key to Measurement Tool Buttons

	Calibrate		***Photo-file icon***
	Length Measurement		***Eraser***
	Distance Measurement		***Exit Measurement Function***
	Angular Measurement		

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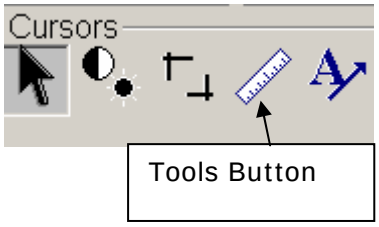
9.1.1 Calibration

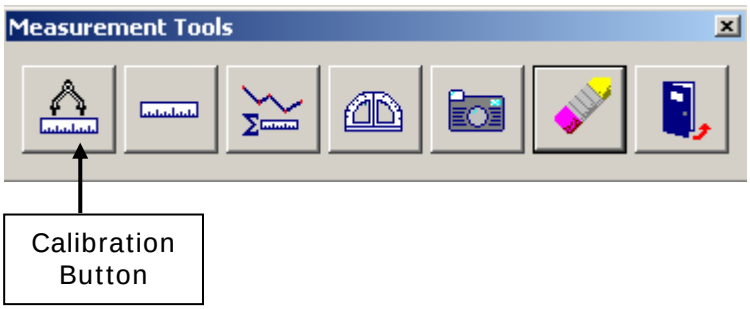
Prior to using Length and/or distance measure, use this button to calibrate against a standard catheter length or other known marker.

NOTE:	Calibration must be performed for each sequence on which a measurement is to be performed. The calibration persists only as long as the sequence is active. See the following description for complete calibration instructions.

9.1.1.1 Set up Calibration



1. Click on the **Tools** button in the Cursor section of the Standard Control box.



2. The ***Measurement Tools*** menu will display.

3. Click on the **Calibration** button.

4. The cursor will change to a compass when over the image area.
5. Left-click and release the mouse at the point at which the measurement is to be started, then move the cursor.
6. A line will be “stretched” across the screen to indicate distance covered.
7. Left-click when the cursor is positioned at the point at which the measurement is to end.
8. A line will be drawn and the calibration dialog box will display.

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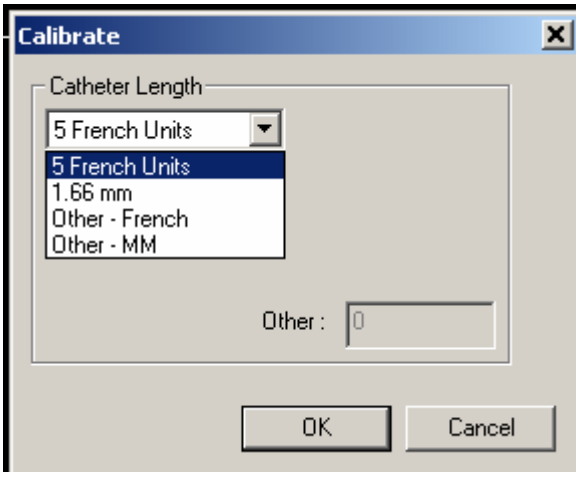
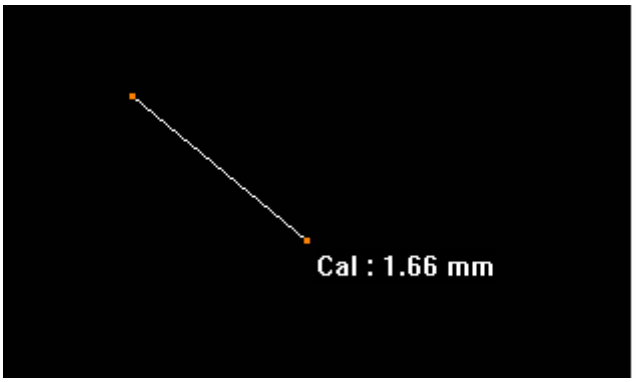


Calibration Dialog Box

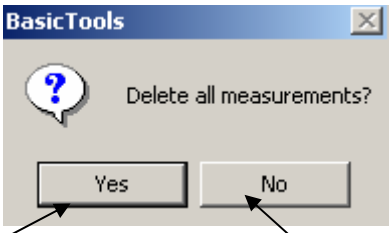
9. Choose the catheter size by selecting from the drop-down menu, then click OK.

10. The length of the line will display with the correct calibration units.



Line Created Using Calibration Button

11. To delete the line completely use . The Basic Tools confirmation dialog box will display.



Select **Yes** to delete all measurements displayed on screen.

Select **No** to cancel delete request.

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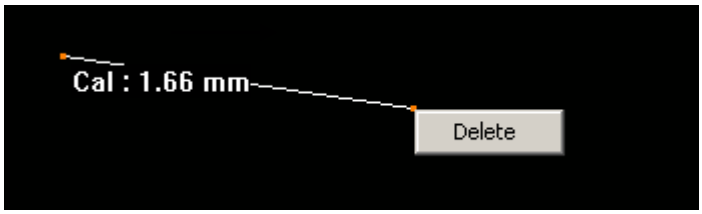
9.1.1.2 Delete Calibration

To delete only the calibration setting:

1. Right-click on either of the end points (dots) of the line.
2. The **Delete** button will display.



3. Click the **Delete** button to delete calibration entirely.

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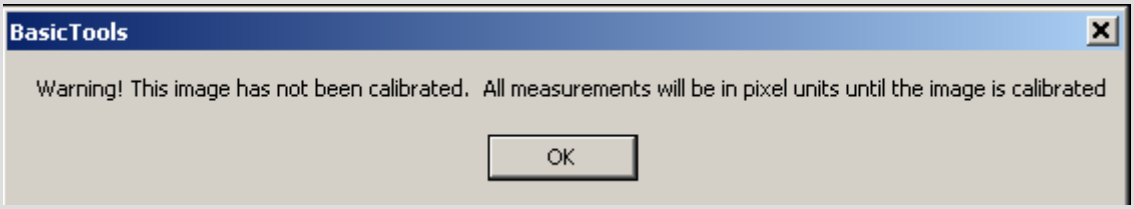
9.1.2 Length Measure

Use Length Measure to perform a quick length measurement on an image. **The length measurement is temporary**. Further, there are certain conditions such as selecting the *Replay* button, where *Measurements* will be deleted from the screen if not saved.

Use the *Photofile* function to create a new image that will include *Measurements* (see chapter 9.1.5 on Photofile)

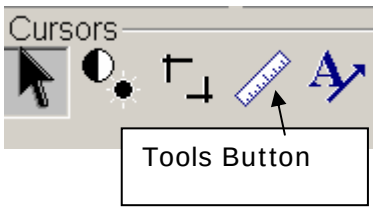
If more than one length needs to be measured, use the distance measure function (see Chapter 9.1.3 on Distance Measure)

NOTE: The tool must be calibrated for each sequence on which a measurement is to be performed, and the calibration persists only as long as the sequence is active. If calibration has not been done, the following message will be displayed when a measurement is attempted.

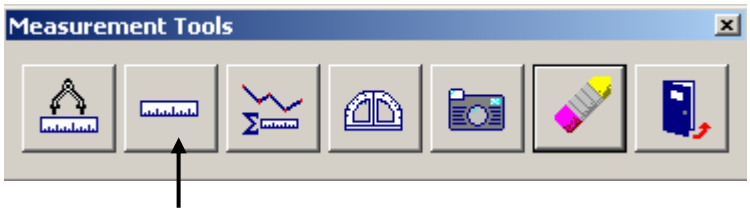

BasicTools
Warning! This image has not been calibrated. All measurements will be in pixel units until the image is calibrated
OK

See Chapter 9.1.1 for complete calibration instructions.

9.1.2.1 Set-up Length Measure



1. Click on the **Tools** button in the **Cursor section** of the Standard Control Box.



2. The Measurement Tool menu will display.

Length Measurement Button

3. Calibrate the image (follow instructions in Chapter 9.1.1 on Calibration) and then click on the **Length Measure** button.

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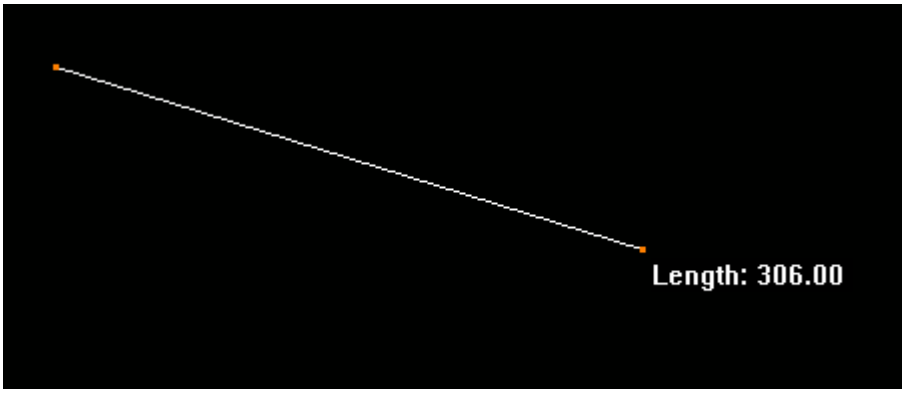
4. The cursor will change to a small ruler when over the image area.

5. Left-click and release the mouse at the point at which the measurement is to be started. Then move the cursor. A line will be "stretched" across the screen to indicate distance covered.

6. Left-click the mouse when the cursor is over the point where the measurement is to end.

7. A line will be drawn and text will indicate the length of the line in the correct units and that the correct calibration setting is used.



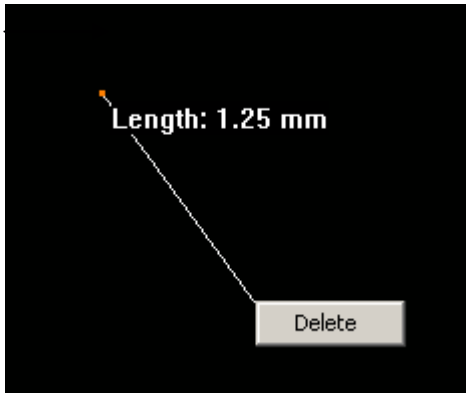
Line Created Using Length Measure Button

9.1.2.2 Delete Measurement

To delete an individual measurement setting (not all measurements):

1. Right-click on either of the end points (dots) on the line.

2. The **Delete** button will display.



3. Left click the **Delete** button to delete the measurement.

NOTE:	Measurements outside shutter locations are not printed on designated hard copy.

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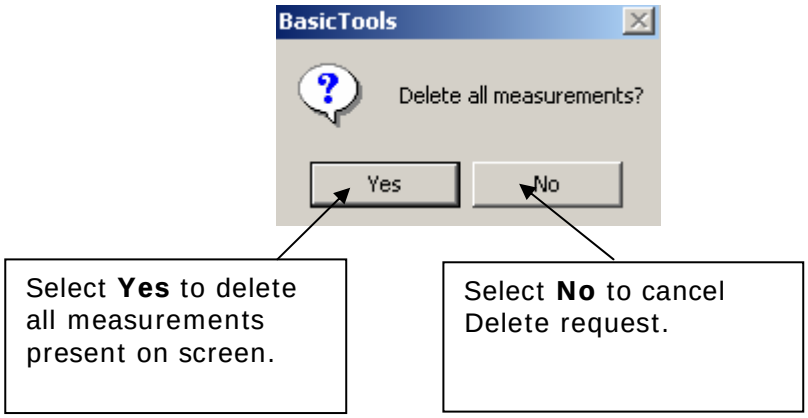
9.1.2.3 Delete All Measurements

To delete the all measurements on the screen, use the **Eraser** button ( ). A Basic Tools confirmation dialog box is displayed



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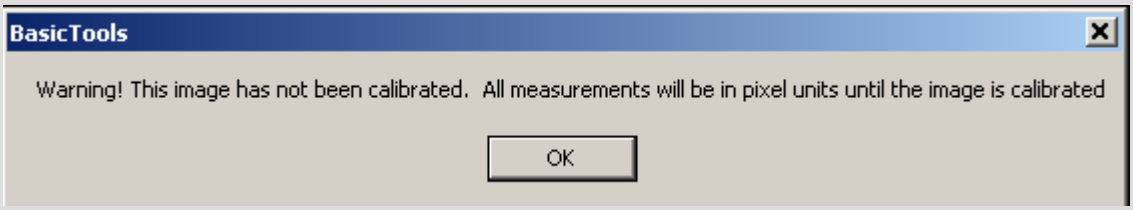
9.1.3 Distance Measure

Use Distance Measure to perform a quick multi-segment distance measurement on an image. The tool must be calibrated for each sequence on which a measurement is performed, and the calibration persists only as the sequence is active.

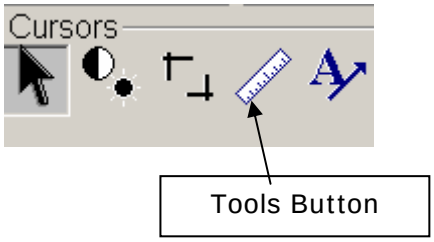
The distance measurement is temporary. Further, there are certain conditions such as selecting the *Replay* button, where *Measurements* will be deleted from the screen if not saved. Use the *Photofile* function to create a new image that will include *Measurements.* (See chapter 9.1.5 on *Photofile)*

NOTE: The tool must be calibrated for each sequence on which a measurement is to be performed, and the calibration persists only as long as the sequence is active. If calibration has not been done, the following message will display when a measurement is attempted.

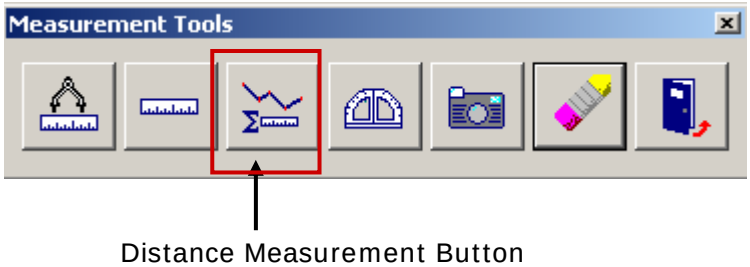

BasicTools
Warning! This image has not been calibrated. All measurements will be in pixel units until the image is calibrated
OK

See Chapter 9.1.1 for complete calibration instructions.

9.1.3.1 Set-up Distance Measure



1. Click on the **Tools** button in the **Cursors** section of the Standard Control Box.



2. The Measurement Tools menu displays.

3. Calibrate the image (follow instructions in Chapter 9.1.1 on Calibration) and then click on the **Distance Measure** button.

4. The cursor will change to a small ruler when over the image area.

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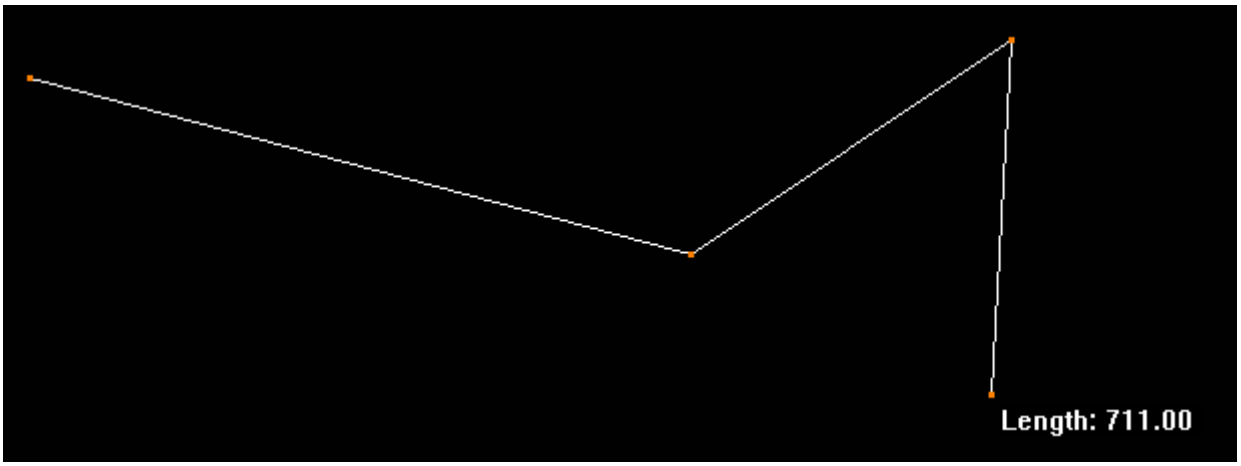
5. Left-click and release the mouse at the point at which the measurement is to be started and then move the cursor. A line will be "stretched" across the screen to indicate distance covered.
6. Left-click the mouse when at a break point in the measurement.
7. Repeat the previous (Step 6) moving the mouse to the next break point and left-click.

NOTE: You can add as many break points in the measurement as necessary.

8. Double-click to end the distance measure and final measurement. Reference Figure below for a sample distance measurement.



Line Created Using Distance Measure Button

NOTE: Measurements outside shutter locations are not printed on designated hard copy or displayed on the main image monitor after photofile.

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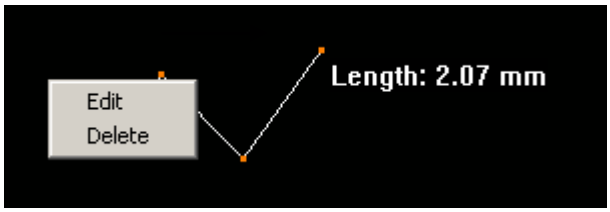
9.1.3.2 Edit Measurement

To edit a line on the distance measurement:

1. Right-click on any of the end points (dots) on the line.
2. The **Edit / Delete** button will display.

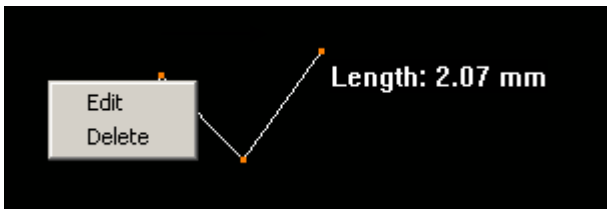


3. Click on the **Edit** button
4. The line will become “live” and can be reset as required.

9.1.3.3 Delete Measurement

To delete an individual measurement setting (not all measurements):

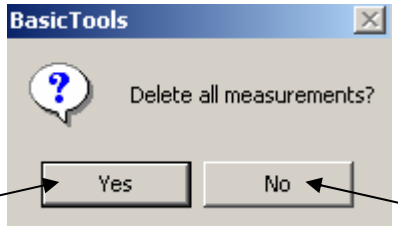
1. Right-click on either of the end points (dots) on the line.
2. The **Edit / Delete** button will display.



3. Left-click the **Delete** button.
4. The measurement will delete.

9.1.3.4 Delete All Measurements

To delete the line completely, use the eraser ( ). A Basic Tools confirmation dialog box will display



Select **Yes** to delete all measurements present on screen

Select **No** to cancel delete function

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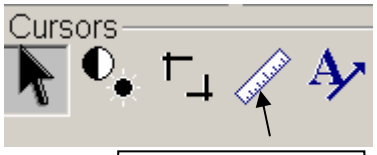
9.1.4 Angular Measure

Use ***Angular Measure*** to perform a quick angular measurement on an image.

The angular measurement is temporary. Further, there are certain conditions such as selecting the Replay button, where Measurements will be deleted from the screen if not saved.

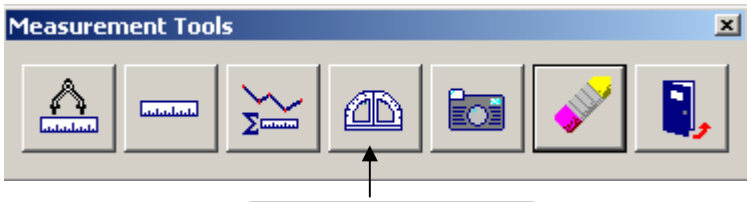
Use the Photofile function to create a new image that will include Measurements (see Chapter 9.1.5 on Photofile).

9.1.4.1 Set up Angular Measure



Tools Button

1. Click on the **Tools** button in the **Cursor section** of the Standard Control box.

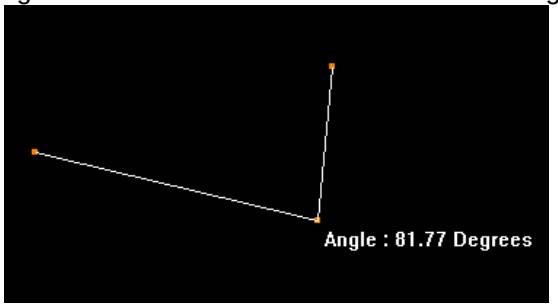


Angular Measure Button

2. The **Measurement Tools** menu will display.

3. Click on the **Angular Measure** button.

4. The cursor will change to a small protractor symbol when over the image area.
5. Left-click on the **X**-axis of the angle to be measured.
6. A dot is placed at the point where the mouse was clicked.
7. Left-click on the **Y**-axis of the angle to be measured.
8. A dot is placed at the point where the mouse was clicked and a line is drawn connecting the two dots.
9. Move the mouse to the vertex of the angle and left click.
10. The angle will be drawn and the size of the angle displayed.



Line Created Using Angular Measure Button

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9.1.4.2 Moving Angle Measurement

To move the text indicating the angle measurement:

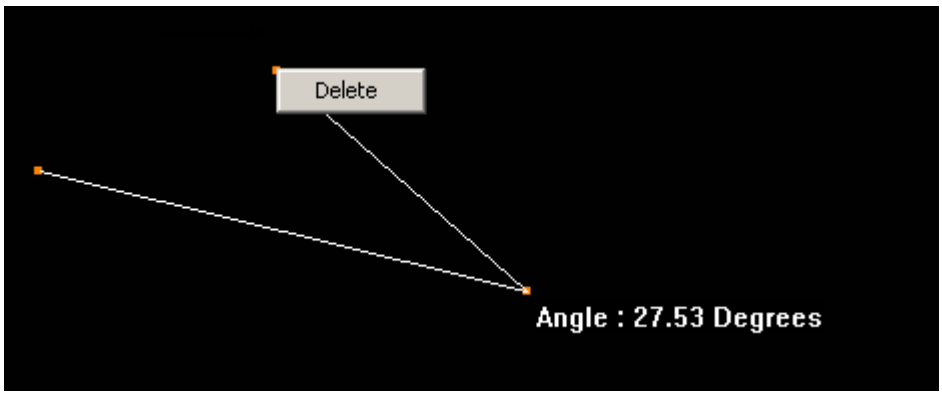
1. Position the cursor over any portion of the text.
2. While holding down the left mouse button, move the text to the desired location on the screen. While the text is being moved, the angle will be highlighted.
3. When the text is properly positioned, release the left mouse button. The angle will no longer be highlighted.

NOTE:	Measurements outside shutter locations are not printed on designated hard copy or displayed on the main image monitor after photofile.

9.1.4.3 Delete Angular Measurement

To delete an individual angular measurement setting (not all measurements):

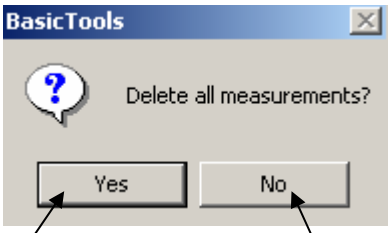
1. Right-click on either of the end points (dots) on the line.
2. The **Delete** button will display.



3. Left click the **Delete** button. The measurement will delete.

9.1.4.4 Delete All Measurements

To delete the line completely, use the eraser . The Basic Tools confirmation dialog box will display



Select **Yes** to delete all measurements present on screen

Select **No** to cancel delete function

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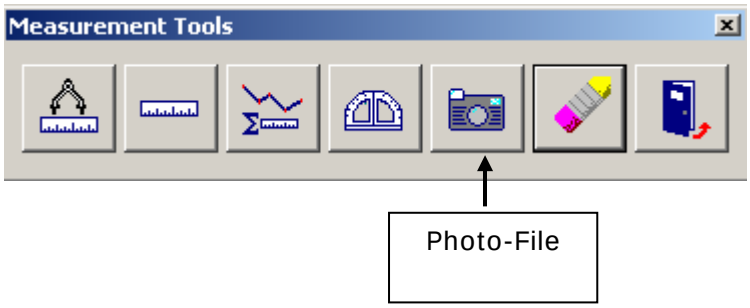
9.1.5 Save Annotated Image as Photo-File

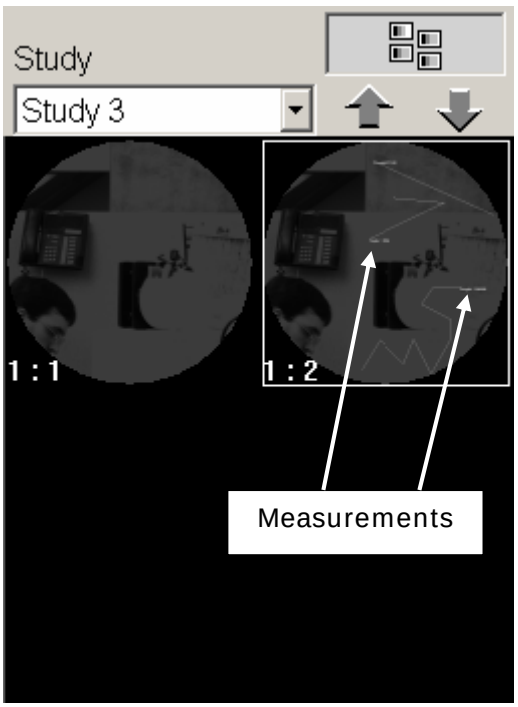
This feature allows for annotated images to be captured and added to patient for future review, printing or export. Essentially, a snapshot is made of the annotated image, which then will appear as part of the thumbnail screen.

All markings are transferred and permanently saved with the image.

NOTE:	This is the only way to save the Measurements and Lines drawn on an image.



1. After entering all measurements, but before exiting measurement mode, click on the **Photo-File** button.
2. A "snapshot" is made of the image that includes all measurements and markings.
3. The image(s) are saved to the **Thumbnail** display for future review, printing or export.



Shown are Thumbnails of image that have been captured by *Photo-file* with its *Measurements.*

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9.1.6 Exit Measurement Tools

Click this button to exit from the **Measurement** tool function.

Unless all measurements have been saved as photofiles they will be deleted and the **Measurement** tool bar will disappear.

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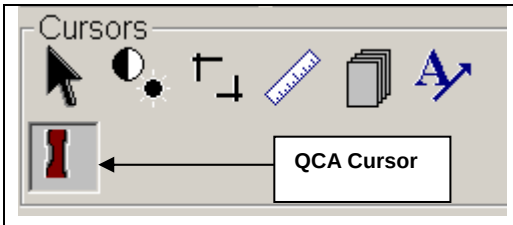
9.2 QCA Processing (DSA only)

The DIS offers a software feature that allows for the measurement of the size of the vessel in order to determine the width and length of the stenosis. Using the catheter as a calibration reference, an accurate measurement can be made of the size of the vessel in order to determine the size of the balloon or stent to be used.

	To access the Stenosis Analysis Processing Panel, click on the *QCA* cursor in the ***Cursor Control Box.*** The ***Stenosis Analysis Control*** box will replace the ***Standard Control Box*** at the top left of the Main Image Screen.

.

Stenosis Analysis Control Box (QCA dialog)

Calibrate	Calibrating the system involves the definition of the Outer Boundaries of a known Diameter. It is important that the Calibration be performed accurately, since this procedure allows the system to assign a Millimeter Value to the width of each pixel of the image. This allows for accurate Measurements. 1. From the top of the QCA dialog, select the Calibrate button. 2. Use the Pointing Device to position the Cursor near either side edge of the item to be used to Calibrate the system.

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NOTE:

Calibration only applies to a single frame out of a *Sequence,* or *Run.*

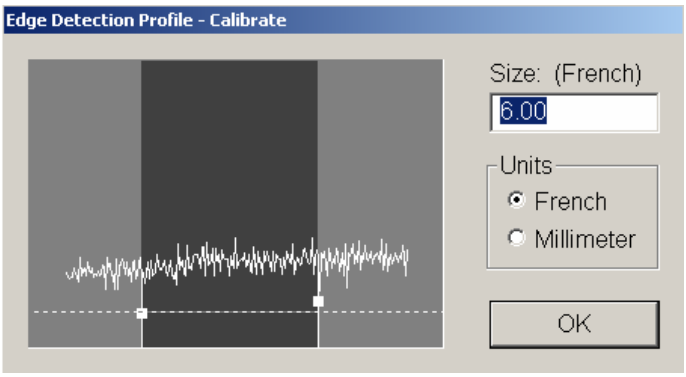
Calibration will NOT carry forward from frame-to-frame within a *Sequence* of images.

3. Click and hold the left button on the Pointing Device.
4. Drag the Cursor across the width of the item. As the Cursor is moved, a line is shown on the screen.
5. Release the Pointing Device button when the line shown on the screen spans the width of the item (it can also go beyond the edge of the item).

   The screen will change as follows:

   - The Edge Detection Profile - Calibrate menu will appear over the image.
   - The portion of the line drawn in step 4 that covers the item
     (as detected by the system) will become shaded.
   - The Default Calibration Value will appear on the image. This Value will be updated once the Actual Value for the item's size is set; user must input upon entry into EVERY Calibration unless using system Default size. System will remember only the choice of Units (French or Millimeter, but not the custom size that was input into the dialog window).

If necessary, the Edge Detection Profile window can be selected and moved so that it does not cover the portion of the image of interest. Catheter Default size for French is 6.00 and Default for Millimeter is 2.00. **This window pops-up on the Main Image Area just after the Boundary of the area of Calibration is determined. The user must re-input any custom sizes upon every use of this tool.**



Edge Detection Profile - Calibrate

- The darker shaded area of this screen represents the width of the item as detected by the system.
- The Size field defaults to French mode, size 6.00 and size 2.00 mm if the Millimeter Units was last selected.
- The two vertical lines represent the Edge Points of the item as detected by the system.

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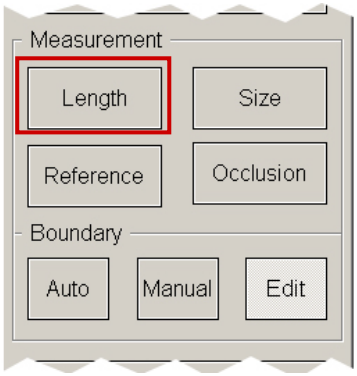
	• The graphical line represents the Pixel Brightness Values for each point along the line as drawn in Step 4 above. 1. To adjust the Edge Points for the Calibration item, select & drag either of the small square boxes found on the vertical lines in the graph until they represent the preferred edges of the Calibration item. 2. Select the desired Calibration mode: either French or Millimeters. 3. Change the numerical value for the item's size by highlighting the Size field and typing in the correct number. The Defaults are French mode, size 6. 4. Select the OK button to accept the entries as they appear in the menu. To maintain Measurement accuracy, Calibration should always be performed on the frame that Measurements are being done.
 	1. In the Measurement section of the QCA dialog, click on Length button. 2. The Cursor becomes a Crosshair. 3. Position the Cursor at the Starting Point along the Centerline of the vessel. 4. Click and hold the left button on the Pointing Device. 5. Drag the Cursor along the path of the Centerline Area of the vessel. 6. When the Cursor is at the last desired point, release, and then double click the left Mouse button. 7. The system will automatically calculate a Vessel Boundary starting at approximately the First Control Point and ending approximately at the Last Control Point. 8. Double-click the left Mouse button to check that all the desired points are entered. 9. The Value will then be displayed on the screen next to the line.

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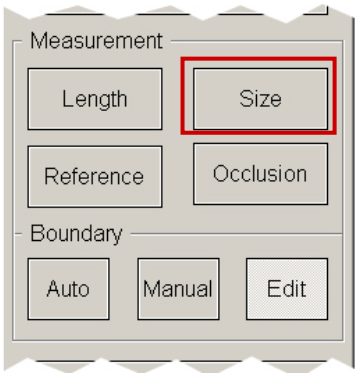
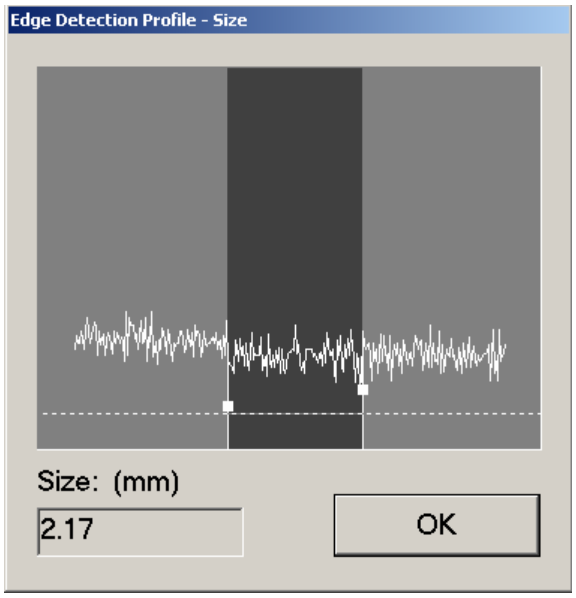


This function allows the measurement of the width of any place along the vessel, or a length of balloon needed for a particular lesion.

1. In the Measurement Section of the QCA dialog, select the Size button from the menu portion of the screen.
2. Use the Pointing Device to position the Cursor at the edge of the vessel area to be measured.
3. Click and hold the left button on the Pointing Device.
4. Drag the Cursor to the other side of the vessel (the line beyond the vessel edge can be extended). As the Cursor is moved, a line is shown on the screen.
5. Release the Pointing Device button when the line shown on the screen spans the width of the vessel. The Edge Detection Profile - Size menu will appear over the image.



6. The size of the vessel, based on the Calibration performed earlier, is given on the image and in the menu window.

   If necessary, the Boundaries of the vessel can be changed by selecting either of the small squares on the vertical lines shown in the graph.

   These lines represent the End Points for the Vessel Area based on the line drawn in Step 4.

7. Select the OK button to close this window. The Measurement Value and Line will remain on the screen.

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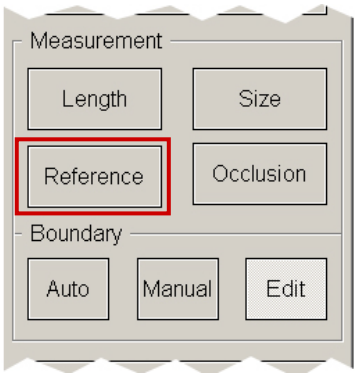
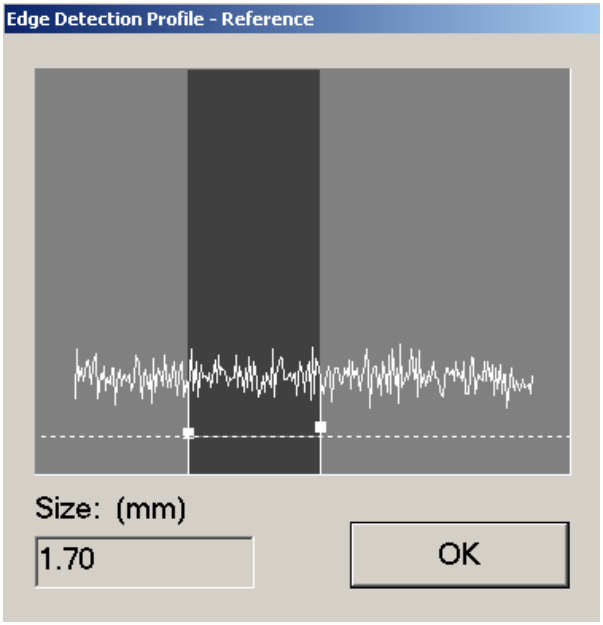


This option allows the size of a normal part of the vessel to be quickly established. This value will be used as a reference for a normal vessel size when calculating percent Stenosis Values.

1. In the Measurement Section of the QCA dialog, select the Reference button.
2. Position the Cursor at the edge of the Vessel Section to be used as a Reference Measurement.
3. Click and hold the left button on the Pointing Device.
4. Drag the Cursor to the other edge of the vessel. As the Cursor is moved, a line is shown on the screen.
5. Release the Pointing Device button when the line shown on the screen accurately spans the width of the vessel. The Edge Detection Profile - Reference menu will appear over the image.



6. The size of the vessel, based on the Calibration performed earlier, is given both on the image and in the Reference window.

   If necessary, the Boundaries of the item can be changed by selecting either of the small squares on the vertical lines shown in the graph.

   These lines represent the End Points for the vessel as drawn in Step 4.
7. Select the OK button to Close this window. The Measurement Value and line will remain on the screen.

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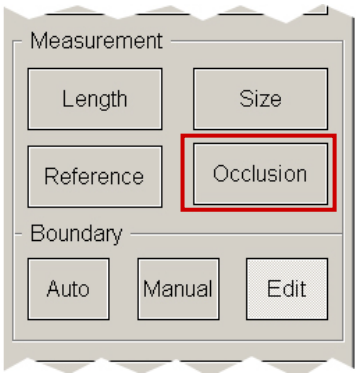
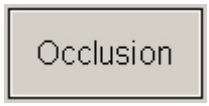
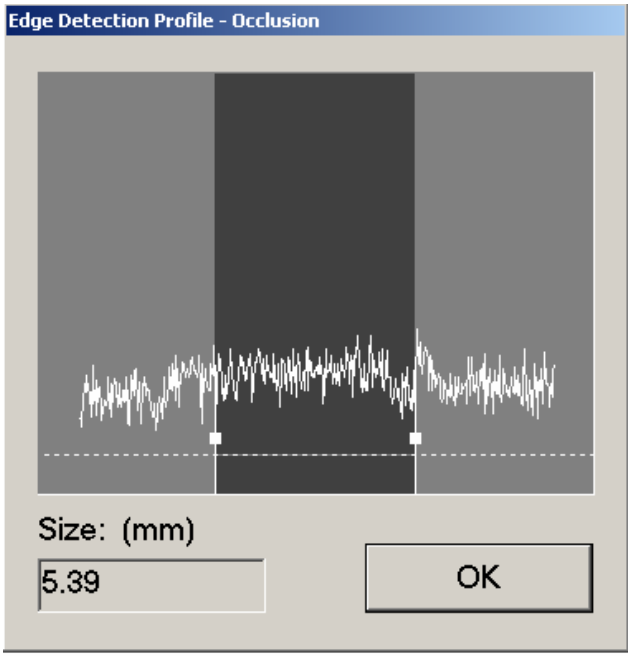




1. This option allows the size of an Occluded Vessel to be quickly established. This will be used as the Value for the Steno tic Region of the vessel when calculating the percent Stenosis Values.
2. In the Measurement Section of the QCA dialog, select the Occlusion button.
3. Use the Pointing Device to position the Cursor at the edge of the Occlusion to be measured.
4. Click and hold the left button on the Pointing Device.
5. Drag the Cursor to the other edge of the occluded vessel. As the Cursor is moved, a line is shown on the screen.
6. Release the Pointing Device button when the line shown on the screen spans the width of the vessel. The Edge Detection Profile - Occlusion menu will appear over the image.



7. The size of the Occlusion, based on the Calibration performed earlier, is given both on the image and in the Occlusion window.

   If necessary, the Boundaries of the item can be changed by selecting either of the small squares on the vertical lines shown in the graph.

   These lines represent the end points for the Occluded Vessel as drawn in Step 4.
8. Select the OK button to close this window. The Measurement Value and Line will remain on the screen.

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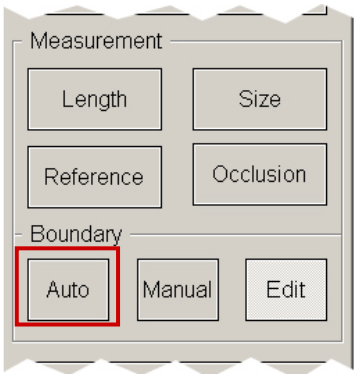

- If there is already a vessel boundary present, it will be cleared from the display.
- The Cursor will be changed to a Crosshair indicating the system is ready.
- There are two different ways of entering centerline points:

Draw Line:
Position the Cursor at the Starting Point along the Centerline of the vessel, and click-and-hold the left button on the Mouse (or other Pointing Device).

Then move the Cursor along the path of the Centerline area of the vessel.

When the Cursor is at the last desired point, release, and then double-click the left Mouse button in the image area. The system will then **automatically calculate a vessel boundary** starting at approximately the first control point and ending at the approximately the last control point.

AUTO:

1. In the Boundary Area of the QCA dialog, click on the Auto button once to Enable.
2. Then, move Cursor to Image Area.
3. Trace one edge of the vessel to be measured from point A to point B and release the Mouse button.
4. Click again on Auto button and the system will automatically complete the trace of the vessel and the Measurements will appear in the image area.

Position Points:
Position the Cursor in the Starting Point, and click the left button on the Mouse. This will set the Starting Point for the Centerline Measurement.

Then, move the Cursor to the next desired point along the Centerline of vessel, and click the Mouse button again. A line will appear connecting each point, as it is set.

Any number of points can be entered (minimum = two). Double-click the left Mouse button to set the last point.

The system will automatically identify the edges of the vessel and calculate the Occlusion information.

NOTE: Clicking the **Right** Mouse button will se the last entered point.

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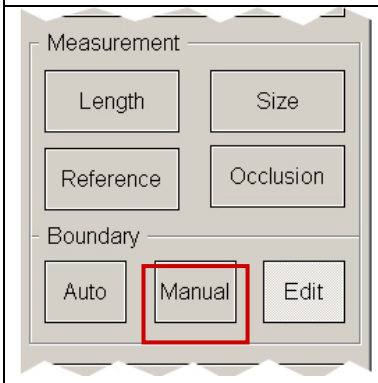
For either type of entry, once done, the Vessel Profile (detected edges) will be drawn on the screen. The system will then automatically display the Stenosis Measurement Results window.

To manually adjust the Vessel Limits and the Stenosis Position in the same manner as with the old version of the feature (select Edit Boundary button, then point and drag a point to the desired location).



The Manual option allows the edges of the entire Vessel Lesion Area of interest to be traced. The system then uses these Boundaries to calculate the percent and actual Measurements (if calibrated) of the region of interest.

NOTE: The system should be calibrated prior to performing Measurements. See part 1.1 for instructions.

MANUAL:

1. Select the Manual Boundary button. If it is not shown on the screen, select the Stenosis Option from the Cursor Pull-down list (bottom right corner of image display).
2. To begin the Trace of the first edge of the vessel, move the Cursor to the desired starting position.
3. Click and hold the left button on the Pointing Device. This sets the Starting Point for the Trace.
4. Drag the center of the Cursor along the Vessel Outline. The Pointing Device button can be clicked to Set Fixed Points along the vessel's edge, but this is not necessary. As the Cursor is moved, a line will extend from the last point set to the position of the Cursor.

To change any portion of the manual boundary that was just drawn: Click the **right** button on the Pointing Device. This will remove a section of the Trace either back to the last Set Point, or to the current position of the Cursor.

1. Double click the Pointing Device button when the tracing of the first Vessel Edge is complete. The Vessel Trace and the Cursor remain on the screen.
2. Repeat Steps 1- 4 to Trace the opposite edge of the vessel.
   The Stenosis Measurement Results window will appear when the Pointing Device button is double-clicked to set the last point (see following Figure).

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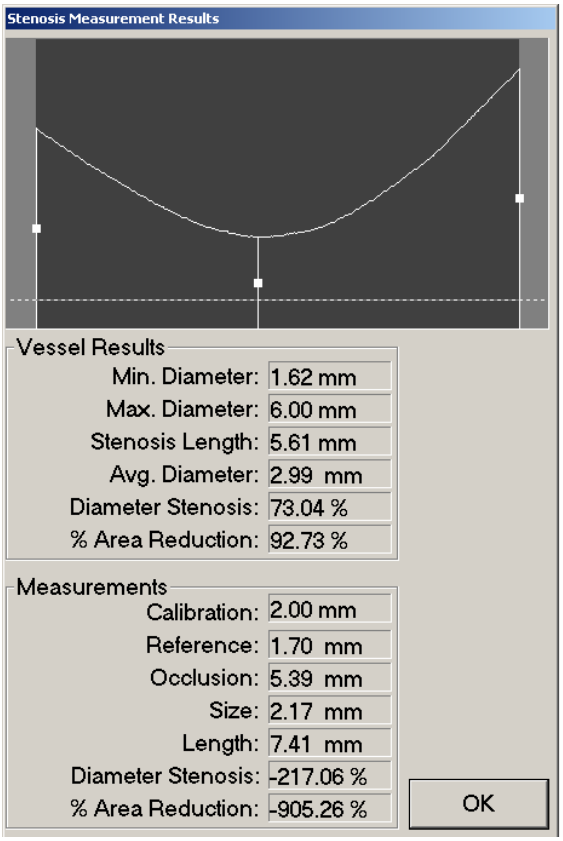

a. The graph represents the distance between the vessel edges.

b. The vertical lines represent the width of the vessel at both ends and the minimum width found within the Vessel Trace.

c. The End Points define the area of the vessel used for the calculations shown in this window.

If necessary, the position of any of the lines shown on the graph can be changed by selecting the small square on the vertical line and repositioning it. The Measurement Values will be automatically updated as any one of the lines is moved.

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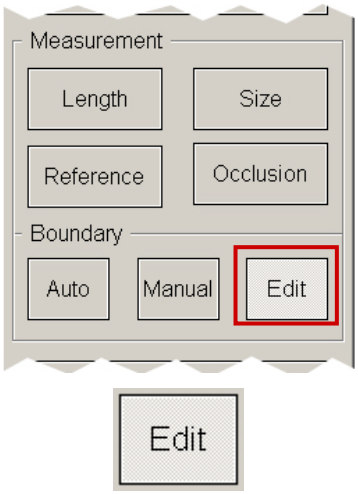
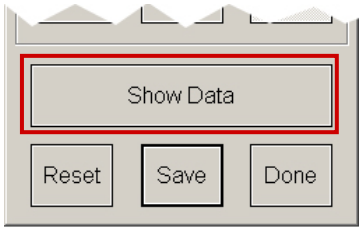


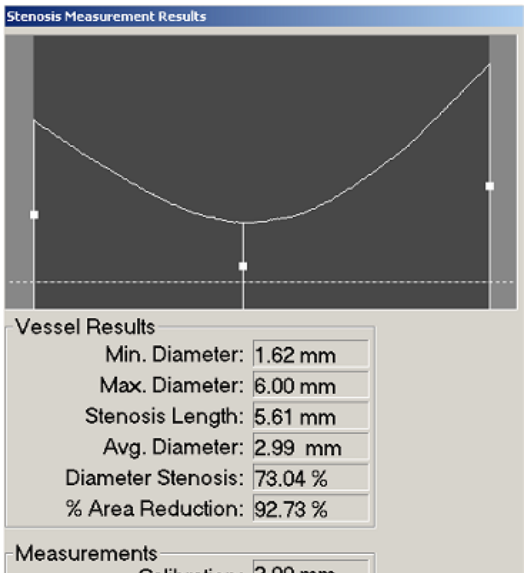
Use this button to make adjustments to Trace points along the vessel, manually adjust the Stenosis Position or Vessel Limits.

To adjust the Trace points along the vessel:

1. Select the OK button in the Results window and then select Edit Boundary. Numerous Connection Points will highlight the two traces.
2. Use the Cursor to select and reposition any of these points in either of the Edge Traces.
3. When the Edge Traces are set, select the Edit Boundary button again to accept the changes. The Connection Points will disappear.
4. To view the Stenosis Measurements using the changed edges, select the Show Data button.



From the lower portion of the QCA dialog, select the Show Data feature button to display the results for any Stenosis Measurements functions recently performed. This window can be moved on the image screen by selecting the Title Bar and dragging it to a different area on the screen.



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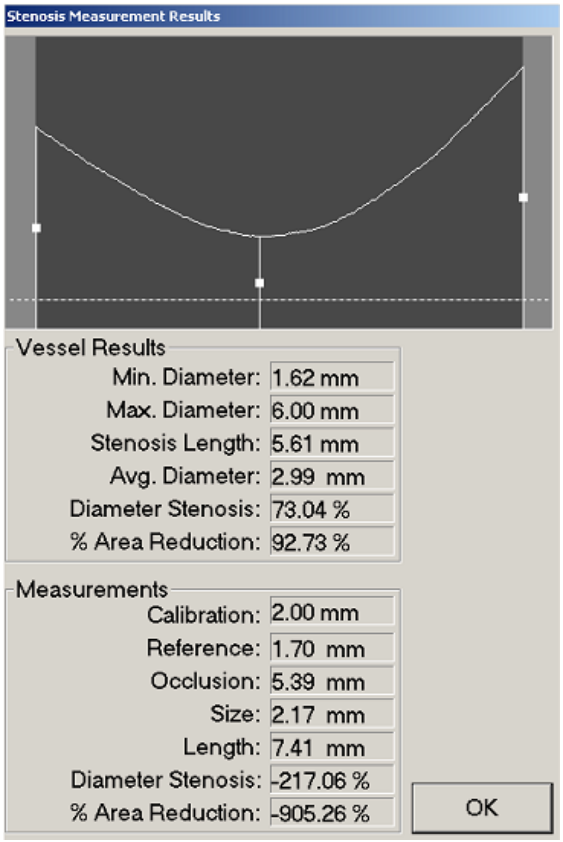
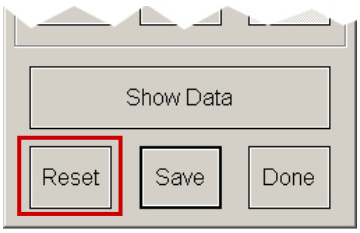


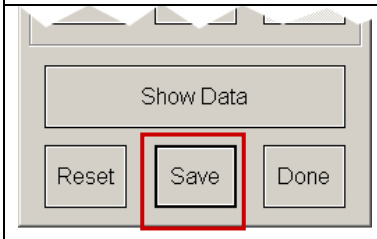
Vessel Results: These Measurements are based on the Vessel Edge Traces entered during the Manual Boundary Procedure (see Part 1.5 of this Section for instructions).

Diameter Stenosis: Percentage difference between the minimum Diameter and the Maximum Diameter of the vessel.

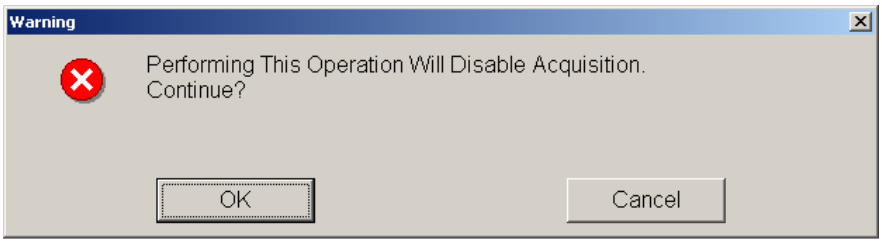
Percentage (%) Area Reduction: Percentage difference in cylindrical areas using Diameter Values from the Reference and Occlusion Measurements.



The Reset button removes all Measurements from the screen.



The Save button saves Measurements made to the single frame in which the Calibration was performed.



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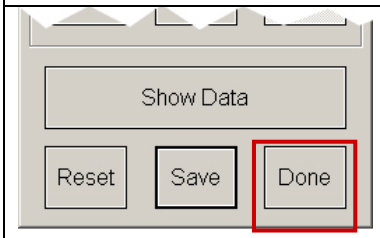
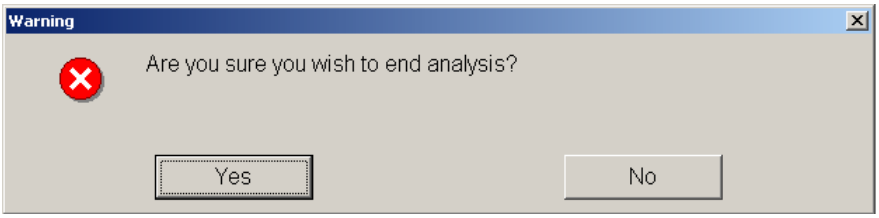
<table>
<tr>
<td>
</td>
<td>After saving, a dialog for printing a report for the Measurements that have just been made becomes available. From this dialog, select the Print feature button.</td>
</tr>
<tr>
<td> 

</td>
<td>Closes QCA screen and Standard Control box (Upper Processing Panel) returns. A Confirmation dialog box will display after clicking on Done button.


Select Yes to Close dialog.
Select No to Cancel or Exit function.
</td>
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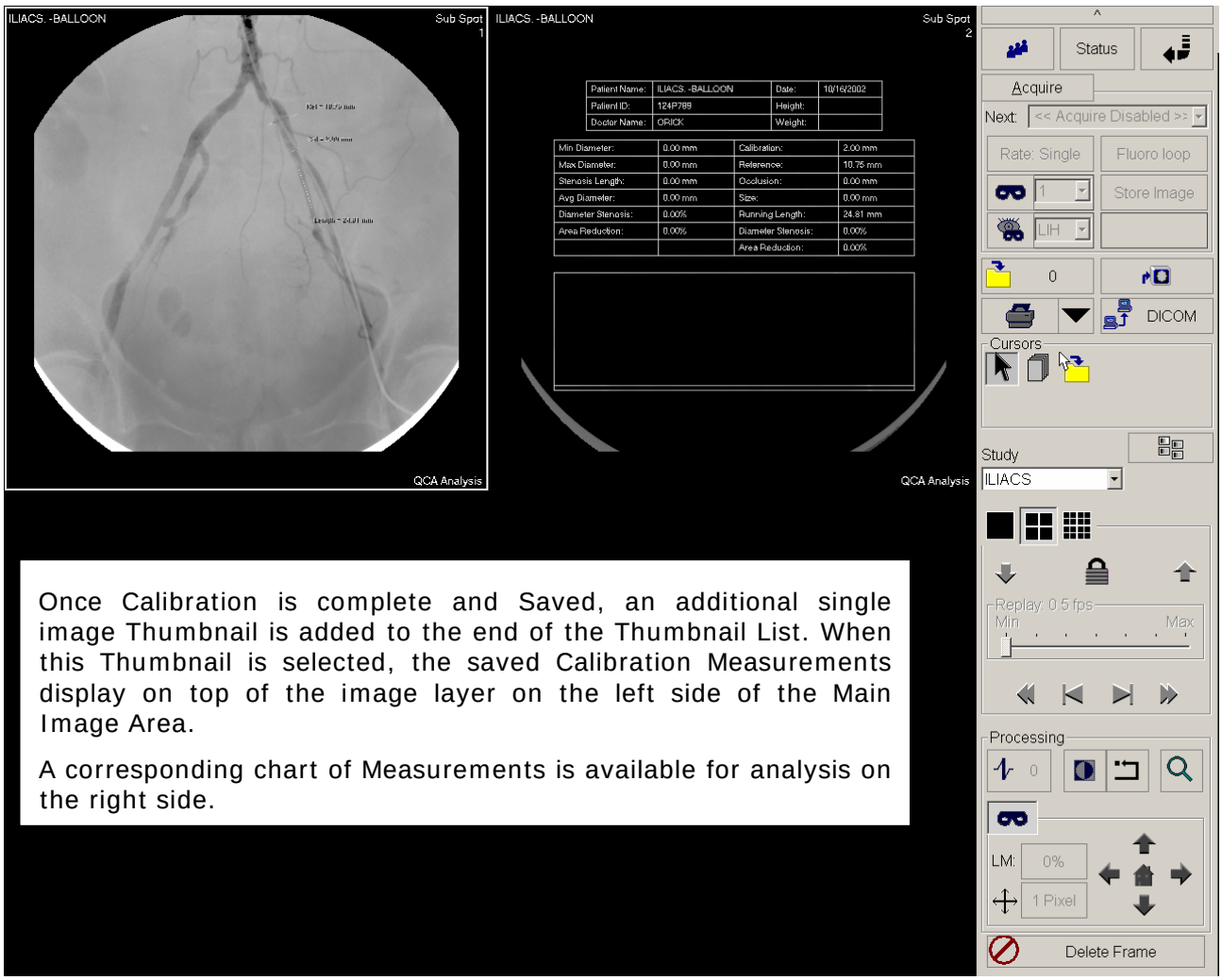
</table>



Once Calibration is complete and Saved, an additional single image Thumbnail is added to the end of the Thumbnail List. When this Thumbnail is selected, the saved Calibration Measurements display on top of the image layer on the left side of the Main Image Area.

A corresponding chart of Measurements is available for analysis on the right side.

Thumbnail of Calibrated Frame with its Measurement Overlay

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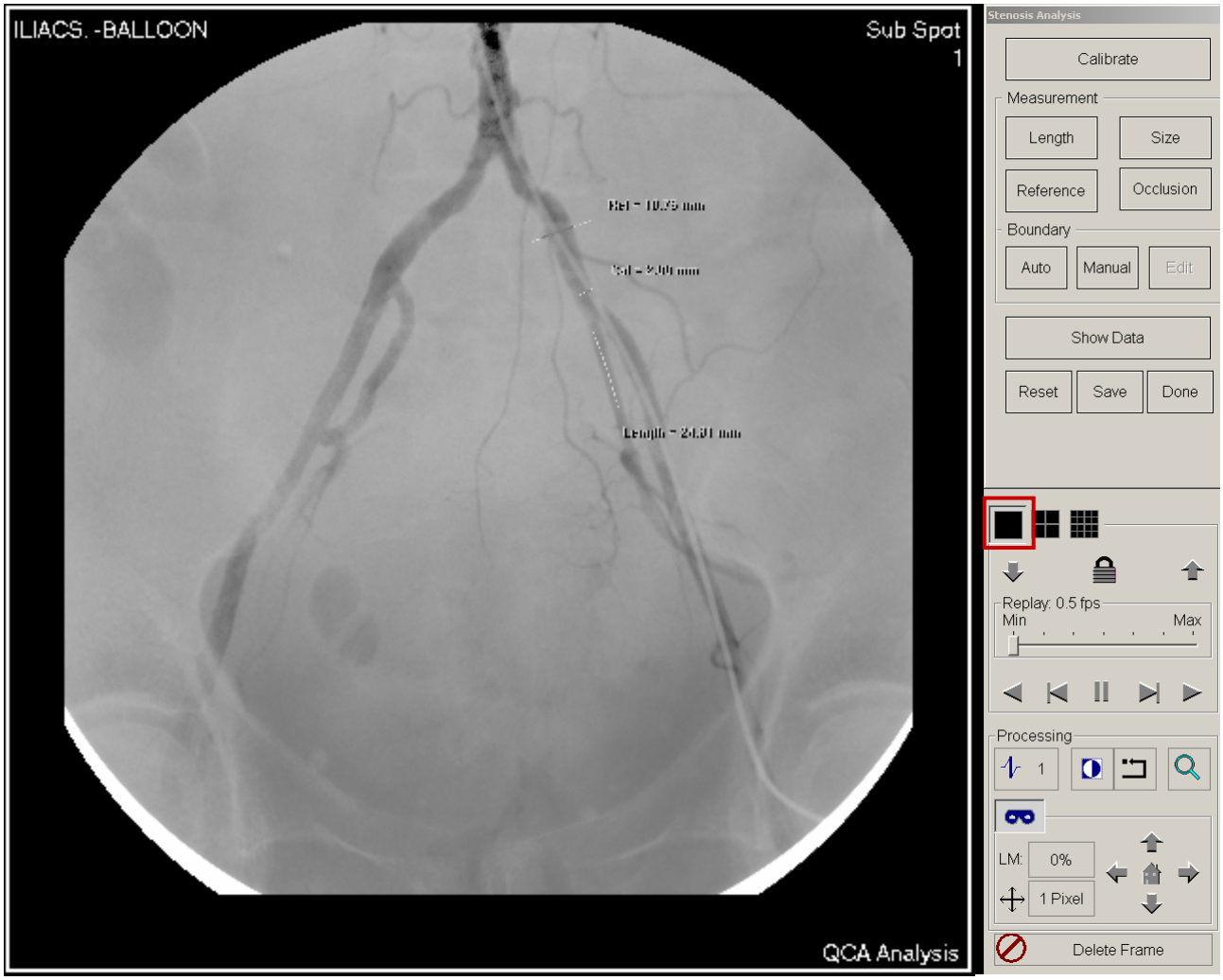

Thumbnail of Calibrated Frame Only (1 frame from a sequence)

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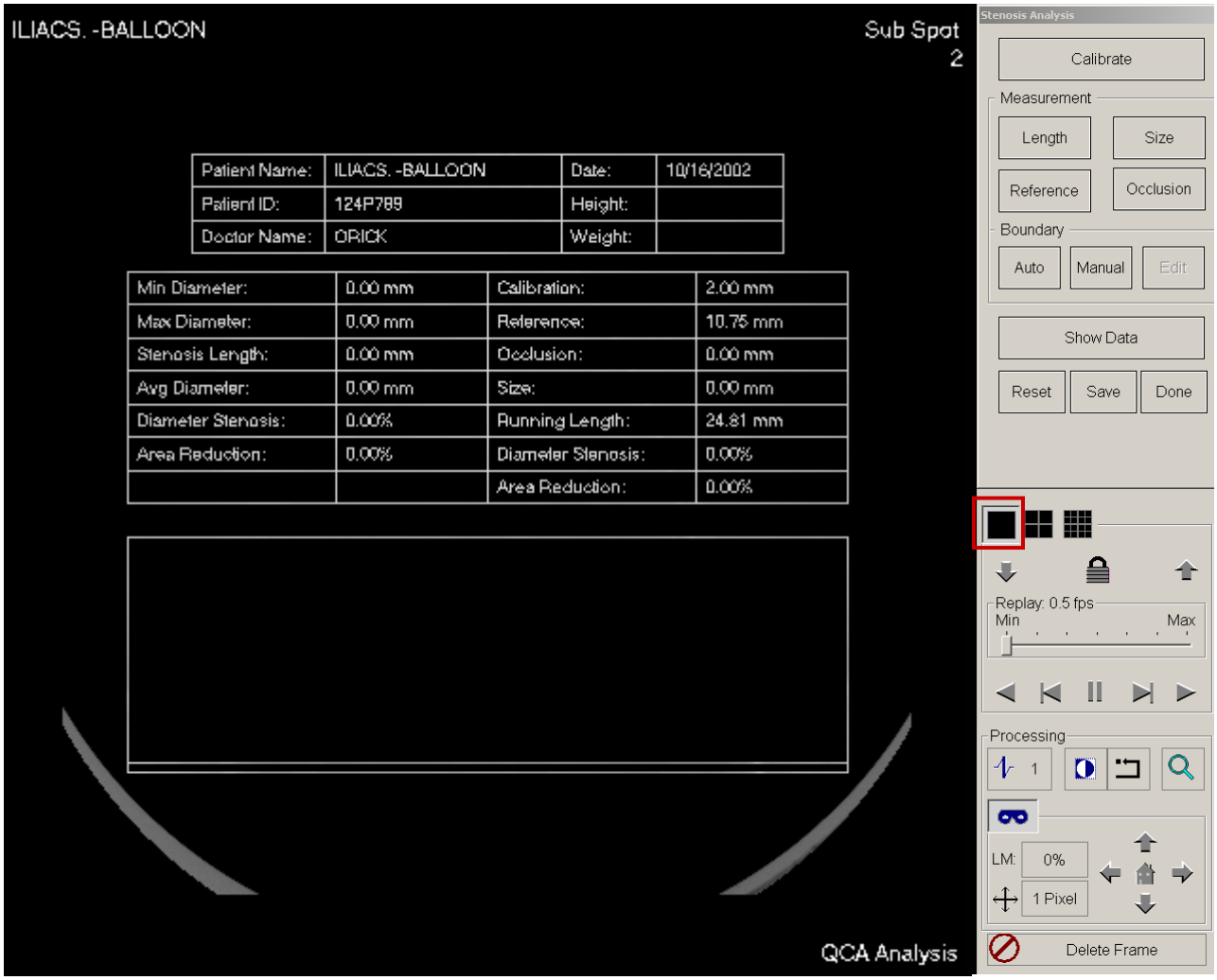

Thumbnail of Measurement Overlay Only

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This chapter describes maintenance and cleaning procedures for GE Precision MPi.
In order to keep the system running in proper order it is important that regular maintenance and checks are made. Such activities are important to ensure safe, continuous, effective and reliable operation of the system.

10.1 PLANNED MAINTENANCE AND USER ROUTINE CHECKS

Periodic maintenance checks of the system help to ensure optimum operational safety, as well as maximum functional efficiency.

It is strongly recommended that a MAINTENANCE RECORD be maintained giving dates of maintenance performed and by whom, complete with any relevant comments.

All procedures in the following Maintenance Programme must be carefully performed to ensure safe and efficient operation of the unit described herein. The technician must ensure that the equipment is electrically disconnected from the mains supply before non-electrical maintenance procedures are performed. Maintenance can only be made by a service engineer.

WARNING: Always disconnect the equipment from the mains before cleaning it or disinfecting it.

CAUTION: Do not allow water or other liquids to enter the equipment as such liquids cause short-circuits and/or corrosion.

The equipment should be checked for obvious faults as indicated below.

Service Checks to be performed by the authorized service engineer only. Refer to Service Documentation wherever applicable.

WARNING: Refer all servicing to appropriate service personnel who are trained to service this equipment and who are familiar with the potential hazards associated with this equipment

NOTE: Maintenance schedule frequency may be determined by certain regulatory requirements of the country or state in which the installation is located. Always check the local codes and regulations when determining a maintenance schedule

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10.1.1 PLANNED MAINTENANCE PROGRAM

It is recommended that the service engineer initiates a periodic maintenance programme with the frequency given in the following schedule.

The periodic maintenance programme provides for checks of operational safety and functioning. Where increased wear must be expected as a result of particularly-severe working conditions, checks should be made at short intervals. The maintenance measures to be taken are described in the service documentation concerned.

WARNING: Should any meter, control, indicator or acoustic signal fail to operate, do not use the GE Precision MPi until a repair has been effected.

Operation of the GE Precision MPi with defective components may expose the operator or the patient to radiation or safety hazards.

Maintenance activities in the table below are to be performed by authorized service personnel only. However, the owner or operator of the equipment must schedule the suggested maintenance activity when required by contacting their local service agency.

Maintenance Frequency	Description of Preventative Maintenance
As governed by local regulations	Check and recalibrate the DOSE measurement.
Every 6 Months AND whenever a related certifiable X-ray component is replaced:	• Clean and re-grease all HV connections using vapour proof compound. • Check that all HV connections are tight. • Clean the control console, remote fluoro control (if used) and main cabinet as needed. Refer to Chapter 10.2 on cleaning, before proceeding. • Ensure that there are no obstructions blocking the ventilation holes at the top of the cabinet, or the louvers on the front door panels. • Perform the X-ray tube auto calibration routine. • Verify the calibration of the generator. • Perform any additional tests required by laws governing this installation. • Check for accurate and correct functioning of all controls, indicators and movements. • Check collimator alignment and field limitation. Check light level, beam alignment and centering. • Check fluoroscopic entrance exposure rate. Check image intensifier entrance-plane dose rate. • Calibrate and align image intensifier assembly and camera system. • Check all mechanical movement limits, physical integrity of complete system and lubrication.

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	• Check the catch system of the footrest and adjust.
Every 12 months:	• Examine the following for any visible damage and replace any damaged components: - The exterior of the control console and remote fluoro control if used, including the membrane switch assembly. - The cable between the control console and the generator main cabinet and between the remote fluoro control (if used) and generator main cabinet. - The hand switch and fluoro footswitch (if used) and the cables connecting these to the console. • Open the generator cabinet and examine the unit for any visible damage: missing or loose ground connections, oil leaks, damaged cables etc. • Check maximum earth (ground) resistance of total system. • Check A.C. and DC supply voltages. • Check fans. • Ensure secure fitting and check for dust and corrosion on PCBs and connectors. • Check electrical and mechanical settings on all motorized movements. • Check interlocks for correct functioning.
Every 5 years:	Replace the lithium batteries on the generator CPU board in the main cabinet with the same manufacturer and type as identified on the original batteries.

10.1.2 USER ROUTINE CHECKS

WARNING: Do not attempt any maintenance of this unit, including troubleshooting, in the presence of any patients or non-authorized staff.

WARNING: Refer all servicing to appropriate service personnel who are trained to service this equipment and who are familiar with the potential hazards associated with this equipment.

WARNING: Any defect, damage or irregular operation of any equipment must be reported to service personnel immediately, and use of the suspected faulty equipment must be discontinued until reparis are made. Continuing operation with faulty equipment may present various safety hazards including risk of increased radiation.

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CAUTION: The AEC and ABS verification procedures require the production of x-rays. Observe correct operating procedures, and take appropriate precautions against x-radiation.

NOTE: Maintenance schedule frequency may be determined by certain regulatory requirements of the country or state in which the installation is located. Always check the local codes and regulations when determining a maintenance schedule.

10.1.2.1 System check - daily

NRT suggests that an image quality and system function check be performed daily, prior to patient data acquisition. This can be done by acquiring images using a phantom, retrieving them, and then deleting the file per the operating instructions in this manual.

10.1.2.2 Touch screen and generator checks - daily

Check all visual displays (warning and status lights, technique displays and indicators, etc) for normal operation.

Check all audible indicators (speakers, beepers, etc) for normal operation, and check that the loudness settings are adequate for the environment.

Check all interconnect cables and connectors for damage.

10.1.2.3 Warm-up procedure - daily

Use this procedure when the generator is first turned on for the day, or when it has not been used for several hours. This procedure provides for exposures at medium power before the tube is used at maximum mA or kV values. This will reduce stress on the X-ray tube. No test setup is required.

1. Select the following:
   - 80 kV.
   - Large focal spot.
2. For a 200 to 300 kHU tube use approximately 160 mAs per exposure. For a 300 to 400 kHU tube use approximately 200 mAs per exposure. Depending on the X-ray tube power rating, select either 100 mA or 200 mA
3. Make one (1) to three (3) exposures (depending on tube loading) at 30 second intervals.

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10.1.2.4 AEC functional check - monthly

The following procedure may be used to verify that the AEC circuits are functioning.

1. Switch the generator ON, and select an appropriate radiographic image receptor.
2. Align the X-ray tube and the selected image receptor such that the central ray is directly over the center field of the AEC pickup device. Set the focal spot to film plane distance to 40 in. (1 m).
3. Select AEC mode of operation. Select center field, large focus.

MINIMUM EXPOSURE TIME:

4. With no object in the radiation field, adjust the collimator or beam limiting device to project a 10 in. X 10 in. (24 cm X 24 cm) field at the image receptor.
5. Select 80 kVp, 100 mA, and a backup mAs of 50 if it is operator selectable. If this is not operator selectable, the default AEC backup settings must be used. Refer to the note at the end of this page to determine the AEC backup mode that has been programmed.
6. Make an exposure and verify that the POST mAs reading is < 2 mAs.

MAXIMUM EXPOSURE TIME:

7. Close the collimator or beam limiting device completely. Place a folded lead apron over the image receptor.
8. Select 60 kVp, 100 mA, and a backup mAs of 50 if it is operator selectable. If this is not operator selectable, the default backup settings must be used. Refer to the note at the end of this page to determine the AEC backup mode that has been programmed.
9. Make an exposure and verify that the error message **AEC BUT ERROR** or **AEC BUT MAS ERR** is indicated in the APR display window after the exposure has terminated. This confirms that the exposure has continued until it was terminated by the AEC backup timer.

NOTE: The AEC backup mode is installer programmable. Three modes are available, **FIXED**, **MAS,** and **MS**. Only the **MAS** mode allows the operator to set the backup mAs for an AEC exposure.

FIXED: The generator will determine the maximum AEC backup time, not to exceed preset AEC backup mAs/ms values or system limits. The characters **AEC** will be displayed in the time window of the LED display during AEC operation.

MAS: Allows the operator to adjust the AEC backup mAs, not to exceed preset AEC backup mAs/ms values or system limits. The mAs value will be displayed in the time window of the LED display during AEC operation.

MS: Allows the operator to adjust the AEC backup ms, not to exceed preset AEC backup mAs/ms values or system limits. The ms value will be displayed in the time window of the LED display during AEC operation.

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10.1.2.5 ABS Functional check - monthly

The following procedure may be used to verify that the ABS circuits are functioning.

1. Switch the generator ON, and select an appropriate fluoroscopic image receptor.
2. Select ABS mode. The indicator LED adjacent to the **ABS** selector button on the control console or on the remote fluoro control will be lit to indicate that ABS is ON.
3. Open the collimator shutters to maximum. With no object in the image field, press the fluoro footswitch. Confirm that the collimator is fully open by observing the monitor.
4. While continuing to press the fluoro footswitch, note the fluoro kV display at the touchscreen or remote touch panel. This should be less than 55 kV.
5. Close the collimator and press the fluoro footswitch. With no object in the image field, ensure that the radiation is fully blocked by observing the monitor. If necessary, cover the image intensifier with lead aprons to block all radiation.
6. While continuing to press the fluoro footswitch, note the fluoro kV display at the touchscreen or remote touch panel. This should be the maximum available fluoro kV, 110 kV or 125 kV (depending on whether the upper fluoro kV limit has been set to 110 kV or 125 kV).
7. Place an absorber (7.9 in (20 cm) of water, or 1.5 in. (3.8 cm) of pure aluminum, or equivalent) in the center of the image field.
8. Press the fluoro footswitch. While viewing the absorber on the monitor, open the collimator sufficiently to cover as much of the absorber as possible. Ensure that the X-ray beam does not extend beyond the sides of the absorber as stray radiation will adversely affect the kVp reading in the next step.
9. While continuing to press the fluoro footswitch, note the fluoro kV display at the touchscreen or remote touch panel. This should stabilize between 70 and 80 kVp.

10.1.2.6 Collimator light field dimensions - monthly

Instructions in how to check the dimensions of the collimator light field dimensions is described in appendix B.

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10.2 CLEANING INSTRUCTIONS

In order to prevent any patient contamination and according the local regulation, after each procedure, always clean parts of the equipment, which were in contact with the patient (patient table, mattress, image intensifier) with a bactericidal, germicidal and antiviral solution.
Check the solution used is also active against HIV virus and hepatitis B virus.

Adequate cleaning and disinfection is necessary to prevent disease transmission. Be sure to thoroughly clean and disinfect equipment surfaces that contact the patient and all equipment surfaces likely to become soiled during use.
Improper cleaning methods or the use of certain cleaning and disinfecting agents can damage the equipment, cause poor imaging performance or increase the risk of electric shock.
To avoid possible injury or equipment damage:

CAUTION: Do not expose any system component surface to water or any corrosive cleaners.

CAUTION: Do not use harsh detergents, abrasive cleaners, high alcohol concentration or Methanol at any concentration.

CAUTION: Do not expose equipment parts to steam or high temperature sterilization.

CAUTION: Never allow liquids to enter the internal parts of the equipment. Do not apply cleaning sprays or liquids directly to the equipment; always use a clean cloth dampened with the spray or liquid. If you become aware of liquid entry, disconnect the electrical supply and have the equipment checked by qualified service personnel before returning it to use.

CAUTION: Equipment parts that enclose electrical components must not be immersed but rather cleaned with a soft dampened cloth, taking care not to allow liquids to enter the equipment.

10.2.1 POSITIONER

Patient contact surfaces should be washed with mild soap in lukewarm water. Surfaces should be scrubbed as needed using a soft sponge, gauze or cloth to remove all visible residues. Scrubbing with a soft bristle brush (such as a toothbrush) may be necessary to reach corners or to remove material that has dried onto the surface.
Subsequent disinfection may not be effective if the surfaces are not thoroughly clean. Rinse all surfaces with clean water to remove visible soap residue, taking care to avoid liquid entry to internal equipment parts. Dry surfaces with a soft cloth to remove any visible residues.

10.2.2 GENERATOR HOUSING

- Never use anything other than soap and water to clean plastic surfaces. Other cleaners may damage the plastic.
- Never use any corrosive, solvent or abrasive detergents or polishes.
- Ensure that no water or other liquid can enter any equipment. This precaution prevents short circuits and corrosion forming on components.
- Disinfection by spraying is not recommended because the disinfectant may enter the X-ray equipment.

10.2.3 PC CABINET

Use a clean, soft cloth to wipe off any dirt or dust on the outside of the cabinet.

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10.2.4 MONITORS

The monitor screen can be cleaned with ordinary household glass cleaner or slightly damped cloth with water – be sure to wipe with a dry cloth afterwards. Be sure to remove power from the monitor and spray the cleaner onto a lint free cloth so the fluid doesn't leak into the electrical components inside the monitor. Vacuum off any dust that has settled on top of the monitor, and make sure no books or papers have been placed on the air vents. Obstructed monitor vents can cause the monitor to overheat or even catch on fire. Anti-static wipes are also available commercially to clean monitor screens.

10.2.5 KEYBOARD

Clean the keyboard by using compressed air contained in a can with a very long nozzle. Aim the air between the keys and blow away all the dust and debris that has gathered there. A vacuum cleaner can be used, but make sure the keyboard doesn't have "pop off" keys that could possibly be sucked up by the vacuum.

10.2.6 MOUSE

1. Remove the bottom cover. Arrows on the cover indicate the direction in which the cover should be rotated.
2. Place two fingers on the mouse cover and push in the direction of the arrows.
3. Once the cover has rotated about an inch, rotate the mouse into its normal position covering the bottom of the mouse with one hand. The bottom should fall off and the mouse ball should be accessible.
4. Once the bottom cover and the ball are removed, three rollers located within the mouse will be visible.
5. Use your finger/fingernail to move the rollers in a horizontal direction. This action will loosen up any debris in the middle or the roller for removal.
6. Once any dirt has been removed, place the ball back inside the mouse and replace cover.

10.3 DISINFECTION

Patient contact surfaces may be disinfected with suitable liquid chemical germicide, bactericide and antiviral. Surfaces must first be cleaned of all visible contamination (see above). The disinfecting liquid must have a minimum contact time with the surface to be effective. Equipment parts should be wiped with a wet cloth or sponge as directed by the instructions for use provided with the disinfecting liquid. Further rinsing or wiping with clear water and drying with a soft cloth should be done to remove any disinfecting liquid residue that may remain. Take care to avoid liquid entry to internal equipment parts.

The equipment, accessories, and connecting cables may be disinfected by wiping them with a cloth moistened with a disinfectant solution. Do not use solvent, corrosive, or phenol-base disinfectants.

The equipment must not be exposed to gaseous disinfectants, and spray disinfectants are not recommended for they can enter the equipment causing short-circuits and/or corrosion. If the procedure room containing the equipment is to be disinfected by means of an atomizer, the equipment must be covered carefully with plastic or similar sheeting. The equipment must be turned off and allowed to cool well in advance of this procedure to prevent convection currents drawing disinfectant mist into the equipment. After the mist has dispersed, the covers may be removed and the equipment disinfected by wiping it in the manner described above.

The equipment must not be used in the presence of disinfectants which vaporize (forming potentially-explosive gases) and all vapour must be allowed to disperse before returning the equipment to use. Disinfection procedures must comply with all current and relevant regulations and recommendations, including those concerning prevention of potentially-explosive hazards.

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10.4 HIGH LEVEL DISINFECTION

In the event that you feel a high level disinfection is necessary due to equipment contact with broken skin, or being used with infected or immune compromised patients, the same patient contact surfaces may be high level disinfected with a liquid chemical germicide rated for high-level disinfections. The same process used as that for intermediate level disinfections is generally followed; however, the time of contact is usually much longer for high-level disinfections.

10.5 LIST OF DISINFECTING AGENTS

The following legally marked products have been used on GE equipment without causing equipment damage.

- SURFANIOS (ANIOS Labs)
- TASKI DS 5001 (Diverseylever Labs)
- ARGOCIDE Formule 2000 (ARGOS Labs)

Use one of these disinfecting agents or other equivalent agent.

10.5.1 GUIDANCE FOR THE USE OF THE CLEANING AND DISINFECTING AGENTS LISTED

Always follow the cleaning and disinfecting agents manufacturer's instructions and precautions for mixing, storage, method of application, contact time, rinsing requirements, protective clothing, shelf life and disposal to help assure effective and safe use of the product.

10.6 RECYCLING

10.6.1 PACKING MATERIALS

The materials used to pack the equipment are recyclable. They must be collected and processed in accordance with the regulations in force for the country where the machines or accessories are unpacked.

10.6.2 MACHINES OR ACCESSORIES AT END-OF-LIFE

Equipment installed in the EU:

The crossed out wheel bin on CE-marked components as shown below indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment

Equipment installed outside the EU:

The elimination of machines and accessories must be in accordance with national regulations for waste processing. All materials and components that could pose a risk to the environment must be removed from the machines at end-of-life and accessories (examples: dry and wet cell batteries, transformer oil, X-ray tube, etc.)

Please consult your service engineer before discarding these products.

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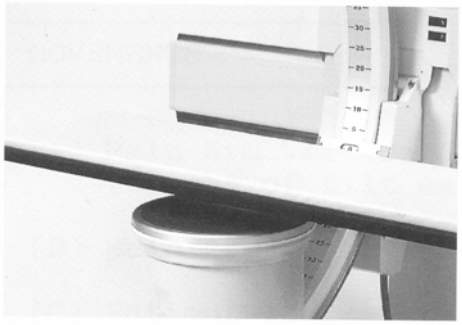
11.1 USING THE STANDARD ACCESSORIES

11.1.1 Patient mattress

Patient Mattress
NRT part no: 02726200

Label for Patient Mattress (Label is positioned in one end of the mattress)



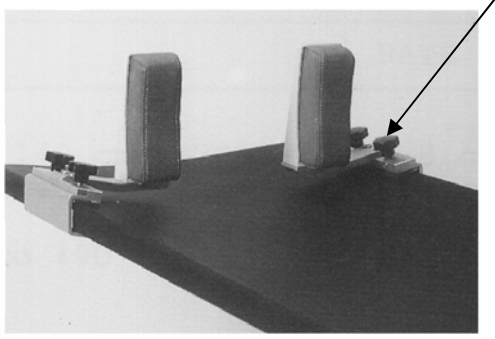
A patient mattress can be used to increase patient comfort and is to be placed on the patient table prior to positioning the patient. It is recommended that the mattress is covered to improve hygiene.
Do not angulate the table in any direction if the patient is not secured as the mattress and the patient may slide.

11.1.2 Shoulder supports

Shoulder Support
NRT part no: 02797400

Label for Shoulder Support (Label is positioned as indicated)

A set of shoulder supports is designed to help position and restrain the patient during angulation



towards the Trendelenburg position (max. 45 deg.). Place and secure the shoulder supports when the table is in horizontal position. It is recommended that Fixation Bands or similar always are used to enhance the patient's safety feeling.

1. Place both supports in the required position anywhere along the patient table in parallel with each other. Always use the supports in pairs.
2. Position the supports as close to the patient's shoulders as possible
3. Secure the supports to the table by tightening the finger screws (2 on each side)
4. Check that the supports are now securely fastened to the table.
5. Check that the supports are positioned as close to the patient's shoulders as possible.

The table can now be angulated.

WARNING: The shoulder supports do not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and

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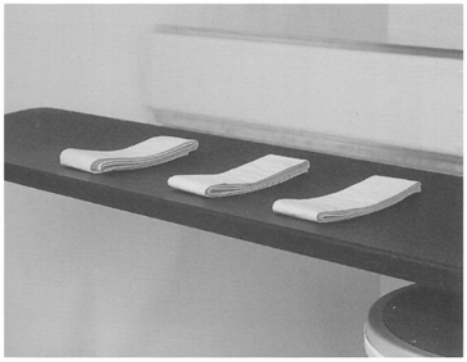
during AP/PA mode change when this accessory is used on the GE Precision MPi.

11.1.3 Fixation straps

3 pcs. Patient Fixation Bands
NRT part no: 02728600

Label for Patient Fixation Bands (Label is positioned on the plastic bag in which the fixations are delivered)



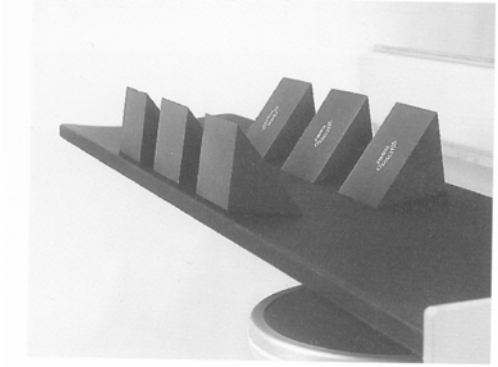
Three adjustable bands with quick-fit Velcro fastenings (length: 1900 cm (748 in) restrain the patient in a fixed position. The bands are often used with other accessories to prevent the patient from moving accidentally. It is recommended that the straps are always used as a help but never as the single means of securing the patient when the table is angulated. The straps can also be sued to link the patient's legs or feet or to prevent movement of the abdomen.

Be sure to secure the straps allowing maximum contact between the Velcro® strips and the ends of the straps. Be careful not to over tighten the straps, as this may be uncomfortable to the patient.
Note that the Velcro® strips are not safe to use when the strips are dirty from threads and dust. Do not use the strap if a strip is dirty, but replace the entire strap.

11.1.4 Foam pads

6 pcs. Triangular Foam Pads
NRT part no: 29260948

Label for Triangular Foam Pads (Label is positioned on the box in which the Foam Pads are delivered)



Improve patient comfort and stability by means of one or more foam cushions – especially helpful during lateral table tilting movements. Six foam pads are delivered with the system. The pads are water resistant (not water proof) and can be disinfected with normal materials or sterilized at temperatures up to 70 deg. Celcius. Note the pads cannot be fixed to the table.

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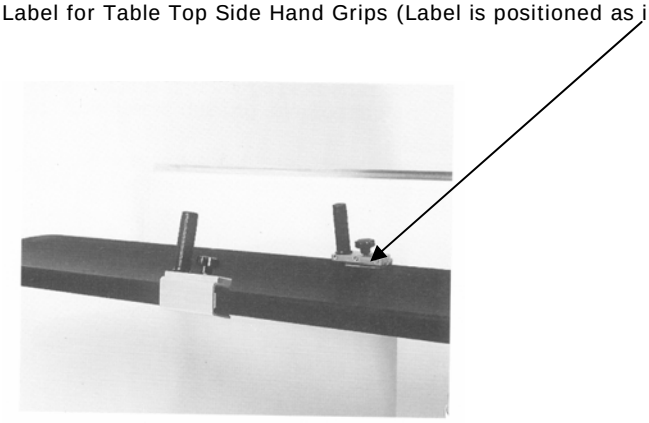
11.1.5 Hand grips

Table Top Side Hand Grips
NRT part no: 02786800

Label for Table Top Side Hand Grips (Label is positioned as indicated)



A set of two hand grips is designed to be fixed in any position along the patient table. The hand grips help the patient maintain a fixed position, while also promoting the patient's sense of security, especially when used in conjunction with other accessories when the patient table is angulated. Do always use the hand grips in pairs. Place and secure the hand grips when the table is in horizontal position

1. Place both hand grips in the required position anywhere along the patient table in parallel with each other. Always use the hand grips in pairs.
2. Position the hand grips as close to the patient's wrists as possible
3. Secure the hand grips to the table by tightening the finger screws (1 on each side)
4. Check that the hand grips are now securely fastened to the table.
5. Check that the hand grips are positioned as close to the patient's wrists as possible.
6. Check that the patient is able to grap each handgrip securely and comfortably.

The table can now be angulated

WARNING: These hand grips do not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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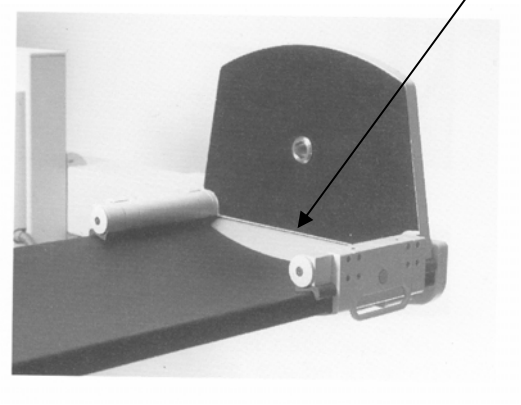
11.1.6 Adjustable Foot rest

Foot Rest	NRT part no: 02786400 Serial No:

Label for Foot Rest (Label is positioned as indicated)



A footrest is designed to ease patient access when the table is in vertical position and to support the patient during table top angulation. The foot rest can be positioned freely along the patient table. The foot rest can also be used in reversed position.

WARNING: THIS FOOTREST MUST BE ADJUSTED BEFORE USE!

MOUNTING THE FOOTREST ON THE PATIENT TABLE

1. Make sure that the patient table is in horizontal position and is placed in an ergonomically suitable working height.
2. Clean the patient table surface and the rubber pads of the clamping mechanism with alcohol.
3. Hold the footrest with both hands with the handles in vertical position.
4. Place the footrest in the required position on the tabletop
5. Check that the 4 black plastic pieces are in correct position
6. Turn down and lock both handles until a loud click is heard
7. Pull out the handles slightly to ensure that both are in locked position. Check that the clamping is not too loose or too tight by attempting to slide it along the patient table in both directions (without using excessive force). If the footrest can be slid or moved slightly along the patient table, DO NOT use the footrest – Call service.

DEMOUNTING THE FOOTREST FROM THE PATIENT TABLE

1. Make sure that the patient table is in horizontal position and is placed in an ergonomically suitable working height.
2. Press the grey button on the side of the footrest
3. Keep the grey button pressed and pull out the handle
4. Turn the handle to its upper position
5. When both handles are released as described lift off the footrest.

WARNING: This footrest does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image

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Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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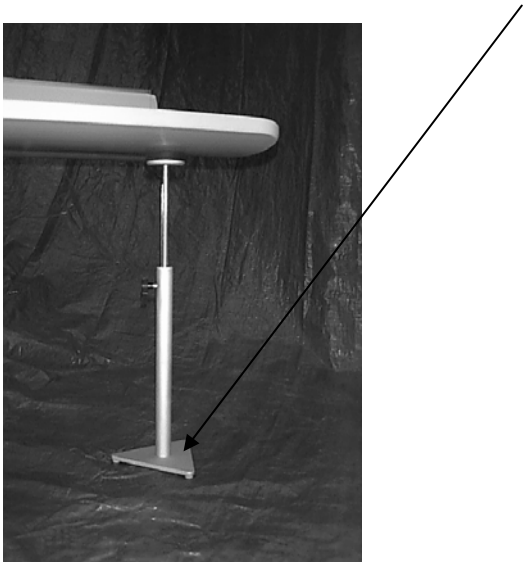
11.1.7 Patient Table Support for CPR

Table Top CPR Support
NRT part no: 02919900

Label for Table Top CPR Support (Label is positioned as indicated)



A height adjustable device intended to give support to the patient table in case of emergency CPR on the table. As the patient table is only supported in one end, the unsupported end will need support in case of emergency CPR in order to avoid deflection of the table. If the table is not supported, cardiac massage will not have the proper effect and the patient could be seriously injured.

1. If possible position the patient table as close to horizontal as possible
2. Place the support on the floor below the unsupported end of the patient table
3. Adjust the height of the support by loosening the finger screw on the side of the support and sliding the upper part of the support until it reaches the patient table.
4. Fasten the finger screw carefully, ensuring that the support cannot move downwards even with minor force

CPR can now be performed.

WARNING: This Patient Table support does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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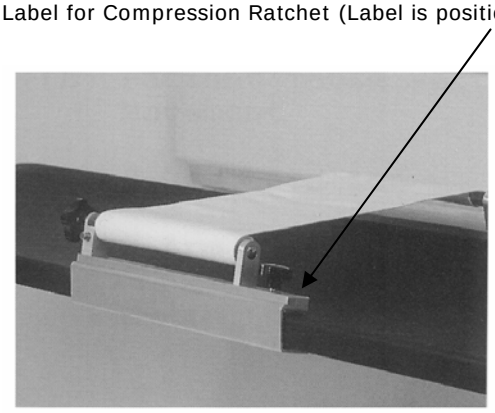
11.2 USING THE OPTIONAL ACCESSORIES

11.2.1 Compression ratchet

Compression Ratchet
NRT part no: 02795400

Label for Compression Ratchet (Label is positioned as indicated)



A compression ratchet with a 9.8 inches (25 cm) wide band for moderate compression and extra patient fixation. It may be used to improve visualization of internal organs.
Note that the patient must be lying on the patient table before attaching the compression ratchet to the table. Do only use the compression ratchet with the patient table in horizontal position.

Placing and securing the compression ratchet to the patient table:
1. Position the patient on the patient table.
2. Attach the non-ratchet part on the opposite of the operator side and secure it by fastening the finger screw.
3. Attach the ratchet part of the set on the operator side of the patient table and secure it by fastening the finger screw.
4. Lead the compression band over the patient
5. Guide the loose end of the compression band into the axle on the ratchet part and gently tighten the band by turning the knob at the end of the axle. Place a hand between the patient and the band in order to avoid friction and to avoid over tightening the band.
6. Tighten the ratchet to the required level of compression.
7. Check that both clamps and the compression band are secured.

Releasing the compression band:
1. Place a hand on the compression band and apply light pressure
2. Press the silver button on the ratchet side to release the ratchet.

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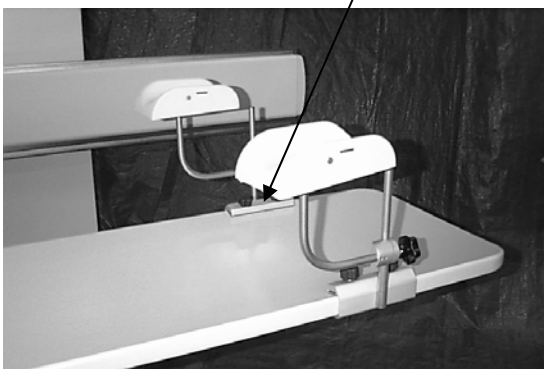
11.2.2 Leg supports

Leg Supports
NRT part no: 02795200

Label for Leg Supports (Label is positioned as indicated)



A set of two leg supports designed for support of the legs during gynaecological and urological examinations. The support can be placed anywhere along the table.
Do only use the leg supports with the patient table in horizontal position as the patient may slide on the table if angulated.
Note: Maximum permissible load on each support is 75 lbs (34 kg).

1. Place both leg supports in the required position anywhere along the patient table in parallel with each other. Always use the leg supports in pairs.
2. Position the leg supports so that the patient's underleg can be supported on the plastic supports
3. Secure the leg supports to the table by tightening the finger screws (1 on each side)
4. Check that the leg supports are now securely fastened to the table.
5. Check that the leg supports are positioned comfortably for the patient.

WARNING: These leg supports do not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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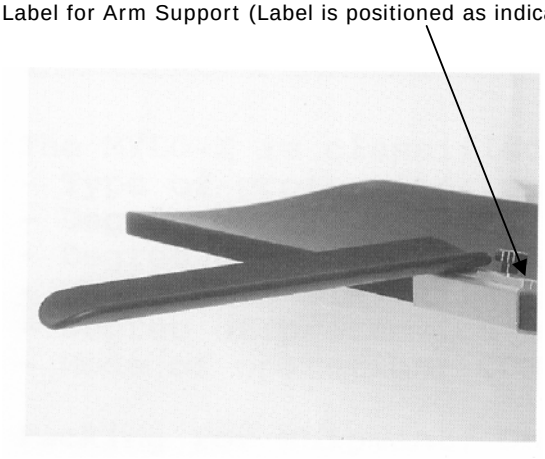
11.2.3 Arm support

Arm Support
NRT part no: 02919400

Label for Arm Support (Label is positioned as indicated)



An adjustable arm support is designed for use during intravenous injections of contrast media or for other infusions or injections. It is recommended that a cushion between the patient's arm and the support is used in order to avoid unnecessary pressure.
Note that hygiene can be improved by covering the arm support with a sterile cover.
Be careful that the arm support will exceed the width of the patient table and that no anti-collision system prevents from moving into the arm support. Be especially careful with the X-ray tube/II when the c-arm is rotated.

Note: Maximum load on the arm support is 33 lbs (15 kg).

1. Position the patient on the patient table.
2. Place both the arm support in the required position anywhere along the patient table.
3. Position the arm support so that the patient's shoulder is as close to the support as possible.
4. Secure the arm support to the table by tightening the finger screw (1 piece)
5. Turn the arm support to a position that is comfortable to the patient.
6. Place the patient's arm on the arm support.
7. Check that the arm support is securely fastened to the table.
8. Check that the patient's arm is comfortable.

WARNING: This arm support does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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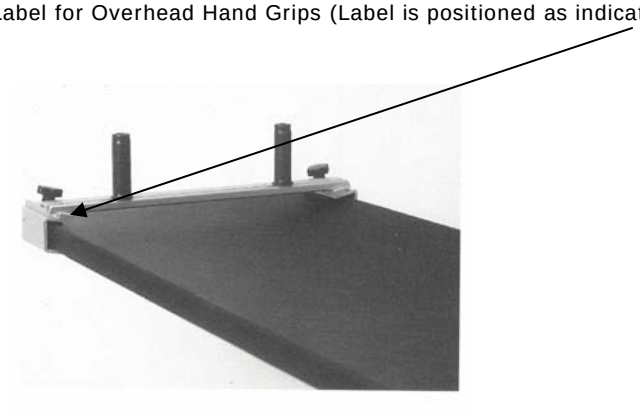
11.2.4 Overhead hand grips

Overhead Hand Grips
NRT part no: 02795000

Label for Overhead Hand Grips (Label is positioned as indicated)



A bar with two adjustable overhead handgrips is designed to help the patient when he/she is required have the arm above the head. The bar should be mounted at the unsupported end of the patient table and may be secured anywhere along the table. The overhead handgrip will usually be used in combination with a footrest to support the patient.

Attaching the overhead handgrip:

1. Slide the bar onto the unsupported end of the patient table so that the finger screws are closest to the unsupported end of the patient table.
2. Position the bar and secure it to the patient table by fastening the finger screws.
3. Rotate the hand grips and slide them on the bar until they have the correct distance for patient comfort. Tighten the hand grips when the correct position is found.
4. Check that the bar is securely fastened to the patient table.
5. Check that the hand grips are securely fastened on the bar
6. Check that the patient is able to grasp both handgrips comfortably and securely.
7. Make additional adjustments to the patient's position if required.

The patient table can now be angulated.

WARNING: These overhead hand grips do not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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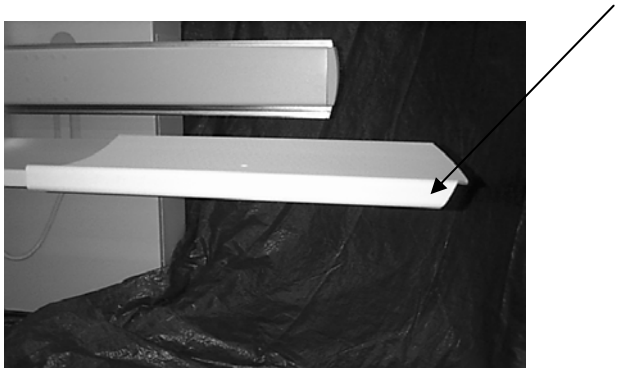
11.2.5 Patient Table extension

Table Top Extension
NRT part no: 02930000

Label for Table Top Extension (Label is positioned as indicated)



A patient table extension (19.6 inches/50 cm) to be fixed at the end of the patient table when extra length is required. The extension is only dimensioned to carry the weight of legs, do not position the patient with head and shoulders on the extension. The extension should be secured with handgrips placed on each side of the patient table just after the extension if Trendelenburg position is required.
Do not tilt in other directions than Trendelenburg as the extension may fall off.

1. Slide the extension onto the patient table from the unsupported end of the table.
2. Position the extension so that the patient table fully covers the hole in the middle of the extension.
3. Position the patient on the patient table and make sure he/she is comfortable and securely fixed to the patient table if Trendelenburg is required.

WARNING: This patient table extension does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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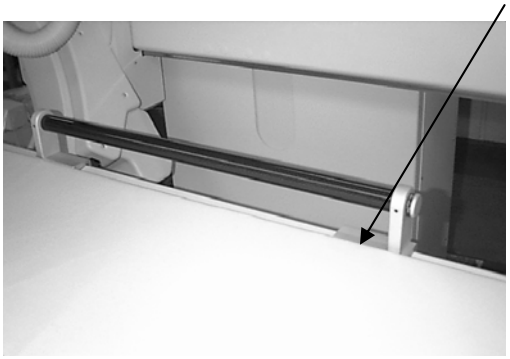
11.2.6 Handbar

Handbar
NRT part no: 02919000

Label for Handbar (Label is positioned as indicated)



A long hand bar to be fixed in any position along the patient table is designed to support the patient while rolling over for various examinations and for smaller patients to feel secure on the patient table.

1. Place the bar on the required side of the patient table in a position where the patient can reach the bar with the hand.
2. Secure the bar to the table by fastening the two finger screws below the table.
3. Ensure that the finger screws are securely fastened
4. Ensure that the patient can reach the bar and is comfortable

WARNING: This handbar does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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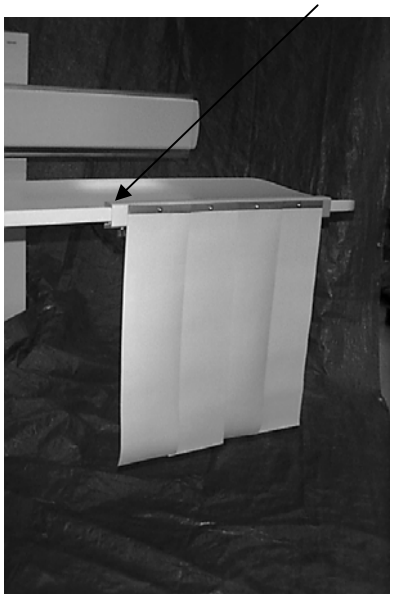
11.2.7 Radiation shield

Radiation Shield
NRT part no: 02919200

Label for Radiation Shield (Label is positioned as indicated)



A radiation shield (31.2 inches/80 cm wide, 0.2 inches/0,5mm Pb) is designed for protection of the operator against stray radiation during x-ray examination. The shield is made of four lead rubber pieces which allows the shield to move according to the patient table angulation and thereby continuos protection of the operator. Note that the use of this radiation shield is meant as an addition to traditional protection. This shield does not replace normal protection clothing.

1. Place the radiation shield on the patient table in the position where the operator is expected to stand.
2. Secure the radiation shield to the patient table by fastening the two finger screws.
3. Ensure that the patient is not discomforted by the radiation shield
4. Ensure that the radiation shield is securely fastened.

WARNING: This radiation shield does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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11.2.8 Infusion stand

Infusion Stand
NRT part no: 02910600

Label for Infusion Stand (Label is positioned as indicated)

An infusion stand is designed to be fixed in any position along the patient table to attach infusion bottles during examinations. The stand is made in a material that allows a certain deflection if the operator should accidentally move the C-arm into the stand. Be careful to avoid collision with the stand as there is no anti collision mechanics or software in the stand.

1. Place the infusion stand in the required position as close to the patient's infusion needle as suitable.
2. Secure the infusion stand to the patient table by fastening the finger screw.
3. Position the patient and suspend the infusion bags on the holder.
4. Ensure that the infusion stand is securely fastened to the patient table.
5. Ensure that the patient is comfortable and that the infusion bags are properly suspended.

WARNING: This infusion stand does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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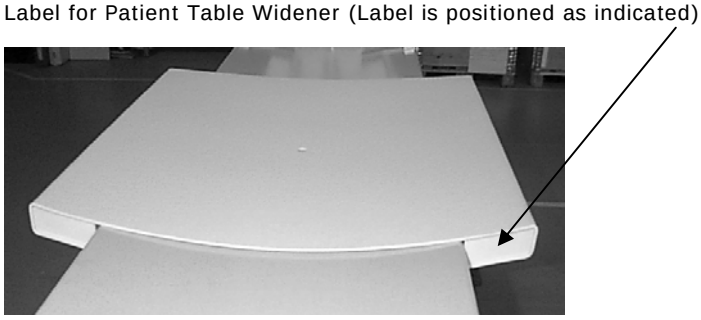
11.2.9 Patient table widener

Table Width Extension
NRT part no: 02946200

Label for Patient Table Widener (Label is positioned as indicated)



A patient table widener (3.9 + 3.9 inches/10+10 cm) is designed to be fixed anywhere on the patient table when extra width is required. The widener is often used in conjunction with the hand grips which are delivered with the system.

1. Slide the widener onto the patient table from the unsupported end of the table.
2. Position the widener so that the patient table fully covers the hole in the middle of the extension.
3. Position the patient on the patient table
4. Secure the position of the widener by fastening hand grips - one at each end of the widener and on both sides of the patient table. This prevents the widener from sliding on the patient table when the table is angulated.
5. Ensure that the handgrips are securely fastened
6. Ensure that the patient is comfortable

WARNING: This patient table widener does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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11.2.10 Sidearm footrest

Sidearm Footrest
NRT part no: 02923900

Label for Sidearm Footrest (Label is positioned as indicated)

An extra sidearm footrest designed to be attached at the suspended end of the patient table in order to further reduce patient access height when the patient table is angulated to 90°. The sidearm footrest is big and stable enough to carry the weight of patients within the normal limits of the patient table.

How to attach the sidearm footrest

1. Ensure that the cover plate on the side of the sidearm has been removed and two support rails have been mounted. If rails have not been mounted, the sidearm footrest cannot be attached. Call for service.
2. Position the patient table in horizontal position
3. Position the sidearm footrest with the rubber plate pointing toward the patient table
4. Push the sidearm footrest downwards until a sound click is heard
5. Ensure that the sidearm footrest is securely locked.
6. The sidearm footrest is now ready for use

How to remove the sidearm footrest

1. Ensure that the patient is no longer to use the sidearm footrest
2. Position the patient table in horizontal position
3. Pull the locking pawl beneath the plastic cover downwards
4. Slide the sidearm footrest upwards while still pulling the locking pawl
5. The sidearm footrest has now been removed

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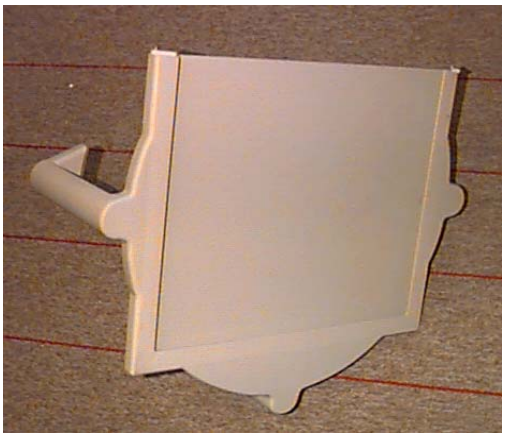
11.2.11 Cassette holder

Cassette Holder for 16” II	Cassette Holder for 12” II
NRT part no: 02973600	NRT part no: 03031700



It shall be mounted on the II (12”/16”) without removing the II touchguard.
The cassette holder is intended to carry a standard film cassette with dimensions LxWxT 384,2 mm x 458,8 mm x 14,3 mm together with a grid with same LxW and thickness 2 mm.

1. Rotate the c-arc (CAR) to +90° (lateral beam projection).
2. Move the patient table outwards if required in order to have space for the cassette holder between the II touchguard and the patient table.
3. Hold the cassette holder onto the II so that there is 10-15 mm (0.4-0.6 in) between the II touchguard and the rear side of the cassette holder. The cassette slide in opening of the cassette holder shall point upwards.
4. Attach the three fixation points tightly onto the II.
5. Slide the cassette / grid into the cassette holder.
6. Lock the cassette in position by turning the two cassette locks in position to avoid that the cassette can fall out (if the c-arc is rotated into the range 0° - -45°).
7. Ensure the cassette holder is securely attached.

The cassette holder is now ready for exposure.

Remove the cassette holder when not in use.

WARNING: When the cassette holder is mounted onto the II, the II anti-collision touchguard is not active.
This poses a potential risk of collision between the cassette holder and the patient or equipment if movements are activated. Due observation of potential collision between the cassette holder and patient or equipment is required at all times if movements are activated when the cassette holder is mounted on the II.

The following warning label is attached to the Cassette holder:

WARNING
When the Cassette Holder is mounted, the II Collision Switch is out of function!

WARNING: This cassette holder does not contain any anti collision features. Therefore, the operator must be very attentive to avoid collision with the Image Intensifier or X-ray tube both during normal operation and during AP/PA mode change when this accessory is used on the GE Precision MPi.

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11.2.12 Accessory rack

A wall-mounted rack providing convenient storage of all MPi accessories when not in use with a patient. Each accessory has a storage shelf or bin designed to support specific accessories. The storage shelf and bins are designed to allow easy cleaning. The overall size of the Accessory Rack depends on the number and type of accessories to be stored on the rack.

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12. SYSTEM UTILITIES

The system utilities menu allows access to the following functions:

- APR EDITOR — Allows the APR to be edited. Changes may be saved to memory.
- LANGUAGE SELECTION — Allows the language for error and status messages to be changed.
- APR BACKUP AND RESTORE — Allows the APR data to be backed-up, and backed-up APR data to be restored. The factory-default APR data is available in several languages.
- SOUND CONTROL — Allows voice messages to be enabled / disabled, and the speaker volume to be changed.
- DATE AND TIME — Allows the date and time to be set or changed.
- TOUCH SCREEN CALIBRATION — Allows for electrical alignment of the touch sensitive membrane with the “buttons” displayed on the touch screen.
- RECEPTOR PROGRAMMING — Allows predefined receptor symbols to be assigned to each image receptor button.
- DATA LINK — Prepares the console for communication with an external computer. This is a service tool intended for use by authorized service personnel only.

12.1 ACCESSING THE SYSTEM UTILITIES MENU

1. From the main console menu, press **SYSTEM UTILITIES**. A pop-up window will be displayed, requesting a password. See the password in the Service Manual for CPI Indico 100 series X-ray Generator, last chapter: Operator’s Manual.
   - Press **CLEAR** to cancel an incorrect password.
   - Press **CANCEL** to return to the main console menu.
   - Press **OK** to access the system utilities menu. After a brief delay, the system utilities screen will be displayed. The message ACCESS DENIED indicates that an incorrect password was used.

12.2 APR EDITOR

It is strongly suggested that you review the subsection ANATOMICAL PROGRAMMING SELECTOR in Chapter 5.4.1.4 before proceeding. A good understanding of the terminology and APR menu structures is needed to make APR changes.

1. From the system utilities menu, press **APR EDITOR.** A screen similar in appearance to the normal operating screens will be displayed. However, as a reminder that you are in APR editor mode, the words **APR Editor** will be splashed over the APR window. If the table stepper function is selected, editing buttons will be displayed at the bottom of the table stepper menu.

2. Refer to the applicable subsections (following) for the procedures to change parameters and technique for existing APR items, and to edit, add, or delete APR, procedural, or menu items.

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NOTE: When a region of interest (i.e. SKULL) is selected, a pop-up menu will appear similar to that in normal APR mode. In addition to "new" ADD, EDIT, and DELETE buttons, a MOVE UP and MOVE DOWN button will be displayed.

The MOVE UP and MOVE DOWN buttons allow the items in a menu or submenu to be rearranged. To do this, select the item to be moved. This will highlight the item. Press MOVE UP to move the selected item up in the list, and MOVE DOWN to move the selected item down in the list.

12.2.1 To change parameters or techniques for an existing APR item

1. Select the APR item to be changed. If the APR item is in a submenu of a menu or procedural item, select the parent menu item or procedural item, then press **OPEN SUBMENU**. It may be necessary to drill down through several submenus to find the desired APR item.
2. When the selected APR item is highlighted, select the patient size. The desired parameters / technique may be changed for that patient size (radiographic kV, mA, mAs, ms, density, AEC / mA/ms / mAs, focal spot, film screen, AEC fields, image receptor). Repeat for all patient sizes for that APR item as required.
3. Repeat steps 1 and 2 for other APR items within that menu or submenu, if applicable.
4. Press **BACK** when finished changing APR items in that menu / submenu. This may need to be done more than once to return to the top APR menu for the selected region of interest. A pop-up window will display asking if you wish to save the changes. Press **OK** to save the changes; **CANCEL** cancels the changes.

NOTE: When editing or adding an APR item, menu item, or procedural item, an English keyboard will pop up at the bottom of the screen. A partial keyboard with international symbols may be displayed at the top of the screen. To display the desired international characters, select the language of your choice from the list near the top right side of the screen. Characters may then be entered via either keyboard.

An ID code window may be displayed to the right of the window for the item text. The ID code is used by some imaging systems, and use of the proper code synchronizes the APR's between the touch screen console and the imaging system. Refer to the appropriate imaging system documentation for valid ID codes.

Touching the ID code window will move the cursor into that window, allowing entry of the ID code. THE I.D. CODE IS NOT AVAILABLE ON ALL SOFTWARE CONFIGURATIONS OF THE TOUCH SCREEN.

12.2.2 To edit (change the name of) an APR item

1. Select the APR item as per step 1 under **"To change parameters or technique for an existing APR item".** The selection will be highlighted.
2. Press **EDIT**. Keyboard(s) will display on the screen as described above, with the current name of the APR item highlighted.
   - Press **Cancel** on the lower keyboard to exit without changing the name.
   - Press **Delete** to delete the highlighted name on the keyboard.
   - Type in the new name for that APR item. Use the **<-** key to back space if corrections are needed.
   - Add / edit the ID code if desired (if displayed).
   - Press **Enter** when finished.

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12.2.3 To delete an APR item

1. Select the APR item to be deleted. The selection will be highlighted.
2. Press **DELETE**. A pop-up window will display asking if you are sure you want to delete this item. Press **OK** to delete the item; **CANCEL** cancels the deletion.

12.2.4 To add an APR item

1. Select the appropriate location to add the APR item. An APR item may be added directly to a main APR menu, or may be added to a submenu of another menu or procedural item.
   If the APR item is to be added to a submenu of a menu or procedural item, select the parent menu item or procedural item, then press **OPEN SUBMENU**. It may be necessary to drill down through several submenus to find the desired location for the new APR item.
2. Press **ADD**. A pop-up window will display allowing you to select three item types to be added. Select **APR Item** (this is the default selection, and the only available selection if adding to a procedural menu).
3. Press **OK** to continue. **Cancel** will cancel this action.
4. Keyboard(s) will display on the screen as described previously.
   - Type in the name of the new APR item.
   - Add the ID code if desired (if displayed).
   - Press **Enter** when finished.
   - The new APR item will appear on the selected menu or submenu.
   - Change the parameters and technique as per the subsection **"To change parameters or technique for an existing APR item".**

12.2.5 To add, edit, or delete a procedural item

1. To delete a procedural item, follow the steps in **"To delete an APR item".** Doing so will also delete the submenu associated with that procedural item.
2. To edit a procedural item, follow the steps in **"To edit (change the name of) an APR item".**
3. To add a procedural item, follow steps 1 to 3 in **"To add an APR item",** except select **APR Procedure** in step 2**.**
4. Keyboard(s) will display on the screen as described previously.
   - Type in the name of the new procedural item.
   - Add / edit the ID code if desired (if displayed).
   - Press **Enter** when finished.
   - The new procedural item will appear on the selected menu or submenu.
   - Select the newly added procedural item. The selection will be highlighted.
   - Press **OPEN SUBMENU**. A "generic" APR item named **FIRST ITEM** has been automatically inserted in that submenu.
   - You may now edit the name and change the parameters and technique for that APR item, and add additional APR items for that procedural item as per previous steps.

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12.2.6 To add, edit, or delete a menu item

1. To delete a menu item, follow the steps in **"To delete an APR item".** Doing so will also delete the submenu associated with that menu item.
2. To edit a menu item, follow the steps in **"To edit (change the name of) an APR item".**
3. To add a menu item, follow steps 1 to 3 in **"To add an APR item",** except select **APR Sub Menu** in step 2**.**
4. Keyboard(s) will display on the screen as described previously.
   - Type in the name of the new menu item.
   - Add / edit the ID code if desired (if displayed).
   - Press **Enter** when finished.
   - The new menu item will appear on the selected menu or submenu.
   - Select the newly added menu item. The selection will be highlighted.
   - Press **OPEN SUBMENU**. A "generic" APR item named **FIRST ITEM** has been automatically inserted in that submenu.
   - You may now edit the name and change the parameters and technique for that APR item, and add additional APR items for that menu item as per previous steps.

12.2.7 KV / MAS STEPPING (optional)

When interfaced to a special procedures stepping table, this option enables the generator to sequentially select varying radiographic techniques as the patient is moved over the image receptor. The kV and / or the mAs may be set to track changes in the anatomy of the patient for each of the table steps.
When kV / mAs stepping is enabled, a series of preprogrammed studies will be available, with each study containing a preprogrammed number of kV / mAs steps. The names and the number of studies, and the kV and mAs, are fully programmable as described later in this section.

12.2.7.1 Selecting the table stepper function

1. Select the image receptor that is configured for peripheral angiography. The anatomical graphic will be replaced by two columns of data near the center of the touch screen. The first column, on the left, lists the preprogrammed studies. The column on the right shows the preprogrammed kV and mAs steps.
2. The radiographic display window on the left of the touch screen will indicate a preselected and possibly arbitrary kV and mAs value. The first exposure in the exposure sequence will not necessarily use the kV and mAs shown in the radiographic display. ***The kV and mAs used for the exposure sequence will be as shown in the list to the right of the selected study.***

12.2.7.2 Running the table stepper function

1. Select the desired study from the list of preprogrammed studies. The kV and mAs sequence will be shown for that selection. If required, edit the kV and mAs values for the selected exposure sequence as described later in this section.

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2. Press and hold the prep / expose button on the stepping table. This will cause exposure number 1 in the exposure sequence to be highlighted, and the kV and mAs in the radiographic display to be updated. Exposure number 1 will be made when the generator receives the expose command.
3. After the table shifts, the next exposure will be highlighted in the exposure sequence. That exposure will be made using revised kV / mAs values, if appropriate, when the generator receives the expose command.
4. Continue the exposure sequence by holding the prep / expose button. Do not release the prep button until finished; doing so will abort the exposure sequence.
5. When finished the exposure sequence, release the prep button. This will reset the exposure step counter to number 1.

12.2.7.3 Editing the table stepper function

1. Enter the **APR EDITOR** mode as described in Chapter 12.2.
2. The table stepper menu will be displayed in a format similar to that in normal operating mode. However, additional buttons for editing the data will be displayed immediately below the list of the available studies and the corresponding kV and mAs steps. Each column of data has its own set of editing buttons; be sure to use the buttons below the column being edited.
3. To edit the list of available studies:
   - To delete an existing study, select the desired item and press **DELETE**.
   - To add a new study, press **ADD**. A new entry will be created named **New Item**. This may be edited as described below.
   - To edit the name of an existing study, select the desired item and press **EDIT**. Edit the name of the item as described under **"To edit (change the name of) an APR item"** in Chapter 12.2.2.
   - To rearrange items in the list of available studies, select the item to be moved and press **MOVE UP** or **MOVE DOWN.**
4. To edit the exposure sequence:
   - Select the desired study. The corresponding exposure sequence will be displayed to the right of the selected study.
   - Select the kV / mAs step to be edited. Then select the desired kV and mAs via the radiographic display at the left side of the console. When any other kV / mAs step is selected in the existing sequence, the previous kV / mAs step will be updated. Alternately, any kV / mAs steps that are to be edited may be deleted, and new kV / mAs steps added as required.
   - To delete an existing kV / mAs step, select the desired step and press **DELETE.**
   - To add a kV / mAs step, select the desired kV and mAs via the radiographic display at the left side of the console. Then press **ADD** to add the selected kV and mAs to the selected study.
   - To rearrange kV / mAs steps within the exposure sequence, select the item to be moved and press **MOVE UP** or **MOVE DOWN**.
   - Repeat the above steps as required.

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12.3 LANGUAGE SELECTION

1. From the system utilities menu, press **LANGUAGE SELECTION.** A pop-up window will display showing the available selection of languages for status and error messages, the factory default APR text, and for voice messages.
2. Press to select the desired language.
3. Press **CLOSE** to exit without changing the language.
4. Press **LOAD** to select the language. A pop-up window will display indicating that the console needs to restart in order to load the new language. Press **OK** to continue; **CANCEL** cancels this action.

12.4 BACKUP / RESTORE

1. From the system utilities menu, press **APR BACKUP AND RESTORE.** A pop-up window will display showing the available backup files and the factory-default APR files in various languages. Pressing **CLOSE** will exit the backup and restore menu.
2. Refer to the applicable subsections (following) for the procedures to back-up the current APR data, and to restore saved APR data. The entire APR (parameters and techniques, APR text, menu structures, etc) is backed up.

12.4.1 To back-up current APR data

1. Press **BACKUP**.
2. Keyboard(s) will display on the screen as described previously.
   - Type in the name of the new backup file.
   - Press **Enter** when finished. The console will return to the APR backup / restore menu.
   - A pop-up window will display indicating that the backup was successful. Press **OK** to continue.

12.4.2 To restore backed-up APR data

1. Select the APR data file to be restored. The selection will be highlighted.
2. Press **RESTORE**.
3. After a brief delay, a pop-up window will display indicating that restore was successful. Press **OK**.

12.4.3 To delete an APR data file

1. Select the APR data file to be deleted. The selection will be highlighted.
2. Press **DELETE**. A pop-up window will display asking if you are sure you want to delete this file. Press **YES** to delete the file; **NO** cancels the deletion.

12.4.4 To restore the factory default APR data

1. Press **RESTORE DEFAULTS**.
2. After a brief delay, a pop-up window will display indicating that restore was successful. Press **OK**.

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The **UPLOAD** and **DOWNLOAD** functions allow backup files on the touch screen console to be saved to an external computer, and allow saved backup files to be downloaded from an external computer to a touch screen console.
These functions require special hardware and software, and are intended for use by authorized service personnel only.

12.5 SOUND CONTROL

1. From the system utilities menu, press **SOUND CONTROL.** A pop-up window will display showing a "volume control" and a voice enable check box.
   - Touch the white square beside **Enable Voice Messages** to select / deselect verbal status and error messages. An "X" indicates that voice message is enabled.
   - Slide the volume control up or down (or use the ◂ and ▸ buttons) to change the volume of sounds (X-ray exposure alarm, key beeps, chimes, etc) and voice messages, if enabled.
   - Press **OK** to save the changes; **CANCEL** returns to the system utilities menu.

12.6 DATE & TIME SETUP

1. From the system utilities menu, press **DATE AND TIME.** A pop-up window that allows setting of the date and time will display.

To set the year:
- Press the up or down arrows adjacent to ***YEAR*** to select the desired year. The selected year will display to the left of the up / down selection buttons.

To set the month:
- Press the up or down arrows adjacent to ***MONTH*** to select the desired month. The selected month will display to the left of the up / down selection buttons.

To set the date:
- Press to select the desired date on the calendar that is displayed.

To set the hour:
- Press the up or down arrows to the right of ***HOUR*** to select the desired hour. The selected hour will display to the left of the up / down selection buttons. This must be selected in 24 hour format, i.e. 2 PM would be entered as hour 14.

To set the minute:
- Press the up or down arrows to the right of ***MINUTE*** to select the desired minute. The selected minute will display to the left of the up / down selection buttons.

The current time will be displayed under ***CURRENT TIME.***

2. Press **APPLY** to apply the current date and time settings without exiting the date and time menu. Pressing **OK** will apply the current settings and return to the system utilities menu. **CANCEL** returns to the system utilities menu without applying changes to the time or date.

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12.7 TOUCH SCREEN CALIBRATION

The touch screen calibration function should be performed if touching the center of the "buttons" does not activate that function, i.e. if the touch-sensitive area appears displaced from the center of the corresponding icon.

1. From the system utilities menu, press **TOUCH SCREEN CALIBRATION**.
2. A pop-up window will display indicating that in order to complete the calibration, the center of each target must be pressed. Press **OK**.
3. Press **CANCEL** to exit without performing the calibration.
4. Press the center of the target at the top left of the screen. This will set up the touch sensitive area in that quadrant.
5. Repeat the previous step for the three remaining targets.
6. A pop-up window will display asking if you wish to accept this calibration. Press **YES** to accept the calibration; **NO** returns to the system utilities menu.
7. If you pressed **YES** in the previous step, a pop-up window will display indicating that the touch screen needs to restart. Press **OK** to restart the console; **CANCEL** returns to the system utilities menu.
8. When the touch screen console restarts, the touch screen calibration needs to be verified. A screen indicating **Please press the target buttons…** will appear. You must press the center of the target at the top left of the screen, plus the center of the next three targets within 30 seconds.
   - If the calibration was done properly, a pop-up window will display indicating that the calibration was accepted. Press **OK** to continue.
   - If the calibration in steps 4 and 5 was not done properly, it will not be possible to press the center of the targets in this step. A pop-up window will display indicating that the calibration failed. Press **OK** to reboot the touch screen and use the previous calibration data.

12.8 RECEPTOR PROGRAMMING

The current image receptor symbols may be replaced with predefined symbols chosen from the receptor symbol library.
Each image receptor button will always select a predefined image receptor (i.e. table Bucky, wall Bucky, DR, etc.). Before changing the image receptor symbols, it must be clearly understood which image receptors are selected by each image receptor button. Each image receptor button should then have a logical and intuitive symbol assigned to that position.

1. From the system utilities menu, press **RECEPTOR PROGRAMMING**.
2. A pop-up window will display showing the image receptor buttons (showing the currently assigned symbols) near the top of the receptor programming window, and the library of available receptor symbols directly below.
3. Select the image receptor button for which the symbol is to be changed.
4. Select an appropriate symbol from the **Available Symbols** library. This will assign the selected symbol to the selected image receptor button.
5. Repeat steps 3 and 4 for each image receptor button to be programmed.
6. Press **OK** to save the changes and return to the system utilities menu; **CANCEL** returns to the system utilities menu.

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12.9 DATA LINK MODE

This prepares the console for communication with an external computer. This is a service tool intended for use by authorized service personnel only.

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13.1 Generator messages and error codes

The console will display status messages during normal and abnormal operation of the generator. This chapter contains tables of those messages and suggests actions to be taken should any malfunctions occur.
Warning messages are cleared automatically after they have been displayed for several seconds; error messages are cleared by pressing **OK** on the error message window.

13.1.1 Operator Messages

These messages indicate the status of the generator. No action is required.

MESSAGE	DESCRIPTION
Generator Ready	Indicates that the generator is ready to make an exposure.
Generator is offline	Indicates that the console is unable to communicate with the generator. Ensure that the generator is switched on if this message is present, and that the console cable is properly connected to J2 on the rear of the console. Consult your service representative if this does not solve the problem.

13.1.2 Limit Messages

These messages indicate that an exposure has been requested that exceeds one or more limits.

MESSAGE	PROBLEM	ACTION
Anode warning level exceeded	Anode has exceeded programmed warning level.	Wait for the anode to cool.
Calibration limit: selected parameter not calibrated	Requested parameter not calibrated.	Consult your service representative.
DOSE accumulated value exceeded	The DOSE accumulated value has exceeded the programmed dose accumulated limit.	Reset the DOSE display.
DOSE rate value exceeded	The DOSE rate value has exceeded the programmed dose rate limit.	Reduce the dose rate.
Fluoro timer warning level exceeded	Fluoro interval timer ≥ 5.0 mins.	Reset fluoro timer.
Generator AEC density limit	Requested density not programmed.	Select another density or request that those steps be programmed by your service representative.
Generator duty cycle warning	The X-ray generator has reached its duty warning limit.	Re-evaluate technique factors. Allow generator to cool if possible. If exposures are

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		continued, serious generator damage may result due to overheating.
Generator kV limit	Requested kV not allowed as generator kV limit has been reached.	None.
Generator kW limit	Requested parameter not allowed as generator kW limit has been reached.	None.
Generator mA limit	Requested mA not allowed as generator mA limit has been reached.	None.
Generator mAs limit	Requested mAs not allowed as generator mAs limit has been reached.	None.
Generator ms limit	Requested ms not allowed as generator ms limit has been reached.	None.
Generator PPS limit	Generator PPS limit has been reached.	None.
Housing heat warning	X-ray tube housing heat has exceeded housing warning limit.	Wait for the tube housing to cool.
Invalid communication parameter	Generator detected invalid parameter within received message, message ignored.	Select valid parameter.
Parameter limit	The requested tomo parameter has reached its limit.	None.
Please deselect tomo table	Request operator to deselect tomo table.	Deselect the tomo receptor.
Please select tomo table	Request operator to select tomo table.	Select the tomo receptor
The selected tomo angle is not valid	Selected tomo angle is not available.	
Tube kV limit	Requested kV not allowed as tube kV limit has been reached.	None.
Tube kW limit	Requested parameter not allowed as tube kW limit has been reached.	None.
Tube mA limit	Requested mA not allowed as tube mA limit has been reached.	None.
Tube mAs limit	Requested mAs not allowed as tube mAs limit has been reached.	None.

13.1.3 Error Messages

These messages indicate that an error has occurred.

ERROR CODE	MESSAGE	PROBLEM	ACTION
E001	Generator CPU EPROM checksum error		Consult your service representative.
E002	Generator CPU EEPROM data checksum error		Consult your service representative.
E003	Generator CPU NVRAM error		Consult your service representative.
E004	Generator CPU Real	Generator CPU real time	Reset time and date.

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	Time Clock error.	clock is not functioning.	Consult your service representative.
E005	Main Contactor Error		Consult your service representative.
E006	Rotor Fault		Power unit off and retry rotor start. Consult your service representative.
E007	Filament Fault		Consult your service representative.
E008	MA Fault		Consult your service representative.
E009	Power Supply Not Ready	Power supply is not ready to make an exposure.	Retry exposure. Consult your service representative.
E010	No kV During Exposure		Consult your service representative.
E011	MA During Exposure Too High		Consult your service representative.
E012	MA During Exposure Too Low		Consult your service representative.
E013	Manually Terminated Exposure	Operator released exposure switch during exposure.	Re-take exposure if necessary. Consult your service representative.
E014	AEC Back-up Timer - Exposure Terminated	AEC exposure exceeded allowed back up time.	Check exposure technique settings. Consult your service representative.
E015	AEC mAs Exceeded - Exposure Terminated	AEC exposure exceeded allowed back up mAs.	Check exposure technique settings. Consult your service representative.
E016	Tomo Back-up Timer - Exposure Terminated	Tomo exposure exceeded back up time.	1. Check exposure technique settings. 2. Increase tomo back up time if necessary.
E017	Uncalibrated Exposure Parameter		Consult your service representative.
E018	Preparation Timeout	Generator has been in prep state too long.	Reduce length of time in prep state.
E019	Anode Heat Limit	Selected parameters will	Reduce parameters

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		cause X-ray tube to exceed its programmed anode heat limit.	or wait for tube to cool.
E020	Thermal Switch Interlock #1 Error	X-ray tube # 1 too hot and its thermal switch has opened.	Wait for X-ray tube # 1 to cool.
E021	Thermal Switch Interlock #2 Error	X-ray tube # 2 too hot and its thermal switch has opened.	Wait for X-ray tube # 2 to cool.
E022	Door Interlock error	Door is open.	Close door.
E023	Collimator Interlock Error	Collimator is not ready.	Check collimator.
E024	Cassette Interlock Error	Cassette is not ready.	Check cassette.
E025	Image Intensifier Safety Interlock Error	II safety is not ready.	Check II safety.
E026	Spare Input Interlock Error	Spare input is not ready.	Consult your service representative.
E027	Receptor Timeout Error - Receptor did not respond within the timeout period		Consult your service representative.
E028	Prep Input Active During Initialization Phase		Consult your service representative.
E029	X-Ray Input Active During Initialization Phase		Consult your service representative.
E030	Fluoro Input Active During Initialization Phase		Consult your service representative.
E031	Remote Fluoro Communication Error	Communication error detected with remote fluoro control unit.	Turn power off and then on to Reset Generator. Consult your service representative.
E032	Console Communication Error	Generator has detected error in communication to console.	Turn power off and then on to reset generator. Consult your service representative.
E033	Warning Lithium Battery Voltage Low		Consult your service representative.
E034	+12VDC Error		Consult your service representative.
E035	-12VDC Error		Consult your service representative.
E036	+15VDC Error		Consult your service representative.
E037	-15VDC Error		Consult your service

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			representative.
E038	Calibration Data Corrupt Error		Consult your service representative.
E039	AEC Data Corrupt		Consult your service representative.
E040	Fluoro Data Corrupt		Consult your service representative.
E041	Receptor Data Corrupt		Consult your service representative.
E042	Tube Data Corrupt		Consult your service representative..
E043	High Voltage Error - kV detected in non X-ray state		Switch OFF generator. Prevent further use of generator, then. consult your service representative.
E044	Invalid Communication Message	Received communication message not valid and ignored.	Reset error.
E045	Communication Message Not Supported	Received message valid, but not supported by this system.	Reset error.
E046	Mode Inhibited	Received message valid, but not allowed during present state.	Reset error.
E047	Fluoro Timer Limit	Fluoro Timer has exceeded time limit.	Reset Fluoro timer.
E048	Focus mismatch error		Consult your service representative.
E049	Not Enabled	Requested function has not been programmed to be enabled.	Consult your service representative.
E050	Generator Limit Data Corrupt		Consult your service representative.
E051	AEC Feedback Error (No Feedback Signal Detected)	Generator has detected no feedback signal from AEC device.	Check that X-ray tube is pointing at correct AEC device. Consult your service representative.
E052	High Small focus filament current error in standby		Consult your service representative.
E053	High Large focus filament current error in standby		Consult your service representative.
E054	AEC Reference out of range		Consult your service representative.
E055	No fields selected in AEC	AEC enabled but no	Select AEC field(s).

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	mode	fields are selected.	
E056	Receptor Disabled		Consult your service representative.
E057	AEC Stop Signal In Wrong State		Consult your service representative.
E058	Console Back-up Timer		Consult your service representative.
E059	Housing Heat Limit Exceeded	X-ray tube housing has exceeded limit.	Wait for tube to cool.
E060	High kV Error		Consult your service representative.
E061	Low kV Error		Consult your service representative.
E062	EXP_SW Signal Active in Standby State		Consult your service representative.
E063	Factory Defaults Set		Consult your service representative.
E064	No Exposure Release		Consult your service representative.
E065	Tomo Device Error		Consult your service representative.
E066	No Sync Signal		Consult your service representative.
E067	Power Supply Duty Cycle Limit	Power supply duty cycle limit exceeded.	Re-evaluate technique factors. Allow generator to cool if possible. If exposures are continued, serious generator damage may result due to overheating.
E069	mAs timeout	The mAs has exceeded its estimated time (falling load only).	Increase mA and/or check technique.
E070	Generator software key error		Consult your service representative.

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13.2 Positioner messages and errors

For reference to panel buttons, see panel layout drawing in Chapter 5.4.2.

When collision messages are shown on the positioner monitor and Touchscreen, observe whether the LED light next to panel button #31 is orange. If the LED is lit, press this button to recover from the collision. If the LED it NOT lit, use the joystick(s) to recover from the collision.

Note that collisions not caused by activation of one of the two touchguards are software calculated collisions. Therefore, collision messages may be shown on the monitor before an actual collision occurs and the movement is stopped to prevent collision.

13.2.1 Positioner Messages

MESSAGE	Message in Full length	Comment
0 AL 0 CU	0 mm Aluminum 0 mm Cupper inserted in the collimator	To change filtration press panel button #5
1 AL 0,1 CU	1 mm Aluminum 0.1 mm Cupper	To change filtration press panel button #5
1 AL 0,2 CU	1 mm Aluminum 0.2 mm Cupper	To change filtration press panel button #5
2 AL 0 CU	2 mm Aluminum 0 mm Cupper	To change filtration press panel button #5
OVERRIDE BUTTON ACTIVATED		**WARNING:** Any movement is possible when this button is activated and all automatic anti-collision features are disengaged.
SECURITY OVERRIDE ACTIVE		The Security Override is active when the key button (#19) is activated to make an AP/PA mode change
RELEASE RECALL2 AND EXP	Release recall2 and expose	See Chapters 6.2.4 and 6.2.5 for description of RA and BC procedures
ALL MOVEMENTS IN MEMORY 1 POS.	All movements stored in memory 1	
ALL MOVEMENTS IN MEMORY 2 POS.	All movements stored in memory 2	
ALL POSITIONS STORED IN 1	All positions stored in memory 1	
ALL POSITIONS STORED IN 2	All positioner stored in memory 2	
BC ABORTED	Bolus chase aborted	

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BC COMPLETED REL. RECALL2 + EXP	Bolus chase completed, release recall2 and expose	
BC READY PRESS GTO2 AND EXPOS.	Bolus chase ready, press recall2 and expose	
BC RUN FOLLOW BOLUS WITH JOYSTK	Bolus chase run, follow bolus with joystick	
CAR POS MUST BE BETWEEN -40/+50	Rotational Angiography procedure can only be made when the C-arc rotation is positioned between -40° and +50°	
MASK RUN PUSH RECALL2 AND EXP.	Mask run, push recall2 and expose	
MASK RUNNING		
MOVE TO END POS AND STORE IN 2	Move to end position and store in memory 2	
MOVE TO STARTPOS AND STORE IN 1	Move to start position and store in memory 1	
MOVE TO STARTPOS PUSH RECALL1	Move to start position and push recall1	
PUSH AND HOLD RCALL MEM2 FOR RA	Push and hold recall2 for rotational angiography	
PUSH RECALL2 + EXP	Push recall2 and expose	
ROTATIONAL ANGIO ABORTED	Rotational angiography aborted	
ROTATIONAL ANGIO COMPLETED		
ROTATIONAL ANGIO RUNNING	Rotational angiography running	

13.2.2 Positioner Error messages

MESSAGE	Problem	ACTION
0-RELAY NOT RELEASED - CHECK IT		Call service
AP PA TURN MUST BE FINISHED	Turn from AP to PA has not been finished.	Press key button and mode turn button again. Keep pressed 20 sec.s before turn will re-activate
C-ARC COLLISION WITH TABLE	C-arc collides with patient table	Use the following joystick(s) to recover from the collision: #27, #29 and/or #30
CEILING COLLISION		Use the following joystick(s) to recover from the collision: #28 and/or #30
COLL TOUCHG DEFECT CALL SERVICE	Collimator touchguard defective	Call service
COLL. WITH FLOOR OR CEILING	Collision with floor or ceiling	Centre movements on joystick(s) #29

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		and #30 to recover from the collision
COLL. WITH TABLE AND C-ARC	Collision with table and c-arc	Centre movements on Joystick #29 and move the patient table upwards (#27)
COLL. WITH TABLE AND COLLI./II	Collision with table and collimator/image intensifier	Centre movements on Joystick #29
COLLIMATOR COLL. WITH TABLE	Collimator collides with patient, table or other device	Use the following joystick(s) to recover from the collision: #27 and/or #30
COLLIMATOR COLLISION		Use the following joystick(s) to recover from the collision: #27 and/or #30
COLLIMATOR TOUCHGUARD ACTIVATED		Press anti-collision button (#31)
COLLISION WITH SIDEARM		Centre movements on joystick(s) #29 and #30 to recover from the collision
CRITICAL POT.METER ERROR	Critical potentiometer error	Re-start RTP and positioner. If the message still shows on the monitor upon re-start, Call Service
EMERGENCY STOP ACTIVATED	Emergency stop on one of the control panels or on the side of the positioner has been activated.	Ensure that the reason for activating the Emergency Stop will not cause a renewed activation. To re-activate the system, release the activated emergency stop (Emergency stop on positioner must be pulled out and emergency stops on the control panels must be turned and pulled)
FLOOR COLLISION		Use the following joystick(s) to recover from the

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		collision: #27, #28 and/or #30
II AND CM TOUCHGUARDS ACTIVATED	Image intensifier and collimator touchguards activated	Use the following joystick(s) to recover from the collision: #26, #27, #28, #29 and/or #30. If neither of the joysticks clear the collision, activate the Security Override button as described in Chapter 2.2.2.3
II COLL. WITH FLOOR OR CEILING	Image intensifier collides with floor or ceiling	Centre movements on Joystick(s) #29 and/or #30
II COLL. WITH TABLE	Image intensifier collides with table	Centre movements on Joystick #29 to recover from the collision
II TOUCHG DEFECT CALL SERVICE	Image intensifier defective	Call service
IMAGE INT. TOUCHGUARD ACTIVATED	Image intensifier touchguard activated	Press anti-collision button
IMAGE INTENSIFIER COLLISION		Use joystick #26 to recover from the collision.
LEFT WALL COLLISION		Use joystick #30 to recover from the collision.
MOTOR OR POT.METER ERROR	Motor or potentiometer error	Re-start RTP and positioner. If the message still shows on the monitor upon re-start, Call Service
PA AP TURN MUST BE FINISHED	Turn from PA to AP has not been finished.	Press key button and mode turn button again. Keep pressed 20 sec.s before turn will re-activate
PA MODE REQUIRED FOR RA	PA mode required for rotational angiography	Make an AP PA mode change in order to perform Rotational Angiography
POT.METER AREA MISADJUSTED	Potentiometer area misadjusted	Re-start RTP and positioner. If the message still shows on the monitor upon re-start, Call Service

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RIGHT WALL COLLISION		Use joystick #30 to recover from the collision.
SAVING FLXERROR.LOG TO LDERROR		Call service
SIDEARM COLLISION		Centre movements on Joystick(s) #29 and/or #30
SIDEARM COLLISION WITH CEILING		Move Patient Table downwards (#27)
TABLE COLLISION WITH FLOOR		Use the following joystick(s) to recover from the collision: #27 and/or #28
TIMEOUT AX5411 - CRITICAL ERROR		Call service
TUBE COLL WITH FLOOR OR CEILING	Tube collides with floor or ceiling	Centre movements on Joystick(s) #29 and/or #30
WAITING FOR STEPRATE	Message during BC or RA run	Call service
WALL COLL. WITH II / TUBE	Wall collision with image intensifier/tube	Centre movements on Joystick(s) #29 and/or #30
WALL COLLISION		Centre movements on Joystick(s) #29 and/or #30

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13.3 Digital Imaging System Messages and Errors

MESSAGE	PROBLEM	ACTION
"GIM Comm Error" Acquisition Disabled		1) Recycle *Generator Power*; Reboot PC, if still error. 2) Click Status>hardware>GIM code = 0.00, if yes. 3) Check connection of green cat5 cable at GIM and PC tower. 4) If still error, contact Service.
"Software Device Failure"		1) Reboot PC. 2) If error still exists, contact Service.
Site Key Requested Window		1) Contact Service
	DICOM Transfer not Possible	1) Check connection of *Network Patch Cord* at wall and PC, at the PC connector, look for green and yellow link lights; if does not work, contact Service.
	Sluggish Response to Icons, Commands	1) Suspect virus or malware infection. If not OK, then contact Service.
	Slow to Boot	1) Clean database of patients older than 1 month if full; if still slow, contact Service.
	Fluoro Dark Contrast Area have Sparkles on Edges	1) Contact Service.
	White or Black Spot Images	1) Is Generator technique and AEC selection correct for the patient being imaged? Check for high Kvp (>100 Kv) and mA (>400 mA) on a small patient. If OK then step 2. 2) Contact Service.
	Lines or other Artifacts In Image, No Image	1) For No Image – Is there a green light on the LCD panel? If not, press the monitor's power button If yes, contact Service 2) Can images be acquired in fluoro? If not, contact Service If so, are the artifacts visible? In spots? Do review images show artifact on old images, on all images. If yes, contact Service.

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	Poor Contrast in Fluoro Image	1) Is the fluoro Kvp > 100 routinely? If so, call service for calibration of dose and camera. 2) Is excess noise present also? Check the collimator shutters to see if they are near the edge of all intensifier fields of view. If no, call Service. 3) In Dr. Pref's, are the Contrast and Brightness sliders off defaults, 2048/4096 4) Is the grid installed?
	Poor Contrast in Spot Images	1) Take Spot of Contrast Phantom – Is Contrast sufficient? Note Generator Kvp and mAs readout. 2) If using a particular doctor in Dr. Pref's, is the Spot AIO enabled and set to Normal. Try different settings. 3) In Dr. Pref's, are the *Contrast* and *Brightness Sliders* off defaults, 2048/4096. If still persists, contact Service.
	System Won't Boot	1) Check 120 VAC power connection and UPS or Isolation Transformer – Are they active (pilot lights, switches turned on)? 2) Attempt to Re-boot – Is power indicator LED lit on PC? If no, then step 3. 3) PC tower fans running? Can you see text onscreen? Does it stop at MSA "Can't Locate NTLOR" = Remove Floppy Retry. 4) If 120 VAC power connections are OK, but still won't boot, contact Service.
	No Mouse or Keyboard	1) On Boot, Bios indicates keyboard error. Check connections and/or test with known good keyboard. 2) If mouse not present or cursor does not move, check connections (splitter, extension cables) and/or replace with known good Mouse; connect directly to PC (bypass splitter and extension cable).

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GENERATOR EXPOSURE TABLES

Table 1 following shows mAs values resulting from preselected mA and ms values (3 point operation). This table also shows the range and interrelation of these loading factors. For example, if in AEC operation it is known that the preset backup mAs limit is 50 mAs and 100 mA is chosen for that technique, then the maximum length of exposure possible (at which time the backup mAs limit is reached) is 500 ms.
In the above example, read down the 100 mA column to the 50 mAs value. Then read across to the left side of the page to the 500 ms value, this will be the maximum time allowed for the stated conditions.

IEC 60601-2-7 requires that this information be provided in a form suitable to be displayed at a prominent location on or near the control console of the generator. To this end we recommend photocopying the tables from this manual as required or removing them from this manual and placed in a suitable location as per local requirements.

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INDICO 100 GENERATOR TECHNIQUE SELECTION
(3 Point Selection: mA/TIME & mAs per IEC)

Time	mA Selected																
(ms)	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000
1.0														.5	.63	.8	1.0
1.2													.5	.63	.8	1.0	1.2
1.6												.5	.63	.8	1.0	1.2	1.6
2											.5	.63	.8	1.0	1.2	1.6	2.0
2.5										.5	.63	.8	1.0	1.25	1.6	2.0	2.5
3.2									.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2
4								.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0
5							.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0
6.3						.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3
8					.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8
10				.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10
12.5			.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5
16		.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16
20	.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20
25	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25
32	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32
40	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40
50	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50
63	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63
80	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80
100	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100
125	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125
160	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160
200	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160	200
250	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160	200	250
320	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160	200	250	320
400	10	12.5	16	20	25	32	40	50	63	80	100	125	160	200	250	320	400
500	12.5	16	20	25	32	40	50	63	80	100	125	160	200	250	320	400	500

Table 1: mAs values vs. mA & time selected

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Table 1 continued from previous page

Time (ms)	mA Selected																
	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000
630	16	20	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630
800	20	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800
1000	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000
1250	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000	
1600	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000		
2000	50	63	80	100	125	160	200	250	320	400	500	630	800	1000			
2500	63	80	100	125	160	200	250	320	400	500	630	800	1000				
3200	80	100	125	160	200	250	320	400	500	630	800	1000					
4000	100	125	160	200	250	320	400	500	630	800	1000						
5000	125	160	200	250	320	400	500	630	800	1000							
6300	160	200	250	320	400	500	630	800	1000								

Table 1 (Cont): mAs values vs. mA & time selected

Note:	***32 kW Generators***	***Maximum mA = 400***
	40 kW Generators	***Maximum mA = 500***
	50 kW Generators	***Maximum mA = 630***
	65 kW Generators	***Maximum mA = 800***
	80 kW Generators	***Maximum mA = 1000***
	100 kW Generators	***Maximum mA = 1000***

Note:

1) mA/TIME values are tube rating dependent. For certain tubes, some mA/TIME selections are not available at higher kV selections.

2) The maximum power output of the Indico 100 family of generators is 32 kW, 40 kW, 50 kW, 65 kW, 80 kW, or 100 kW respectively. The generator software does not allow a kV and mA combination to be selected that exceeds these maximum values.

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Time (ms)	MA Selected																
	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000
1.0														.5	.63	.8	1.0
1.2													.5	.63	.8	1.0	1.2
1.6												.5	.63	.8	1.0	1.2	1.6
2											.5	.63	.8	1.0	1.2	1.6	2.0
2.5										.5	.63	.8	1.0	1.25	1.6	2.0	2.5
3.2									.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2
4								.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0
5							.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0
6.3						.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3
8					.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8
10				.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10
12.5			.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5
16		.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16
20	.5	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20
25	.63	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25
32	.8	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32
40	1.0	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40
50	1.25	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50
63	1.6	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63
80	2.0	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80
100	2.5	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100
125	3.2	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125
160	4.0	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160
200	5.0	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160	200
250	6.3	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160	200	250
320	8	10	12.5	16	20	25	32	40	50	63	80	100	125	160	200	250	320
400	10	12.5	16	20	25	32	40	50	63	80	100	125	160	200	250	320	400
500	12.5	16	20	25	32	40	50	63	80	100	125	160	200	250	320	400	500

Table 1: mAs values vs. mA & time selected

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Time (ms)	mA Selected																
	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000
630	16	20	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630
800	20	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800
1000	25	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000
1250	32	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000	
1600	40	50	63	80	100	125	160	200	250	320	400	500	630	800	1000		
2000	50	63	80	100	125	160	200	250	320	400	500	630	800	1000			
2500	63	80	100	125	160	200	250	320	400	500	630	800	1000				
3200	80	100	125	160	200	250	320	400	500	630	800	1000					
4000	100	125	160	200	250	320	400	500	630	800	1000						
5000	125	160	200	250	320	400	500	630	800	1000							
6300	160	200	250	320	400	500	630	800	1000								

Table 1 (Cont): mAs values vs. mA & time selected

Note:
32 kW Generators Maximum mA = 400
40 kW Generators Maximum mA = 500
50 kW Generators Maximum mA = 630
65 kW Generators Maximum mA = 800
80 kW Generators Maximum mA = 1000
100 kW Generators Maximum mA = 1000

Note:
1) mA/TIME values are tube rating dependent. For certain tubes, some mA/TIME selections are not available at higher kV selections.

2) The maximum power output of the Indico 100 family of generators is 32 kW, 40 kW, 50 kW, 65 kW, 80 kW, or 100 kW. respectively. The generator software does not allow a kV and mA combination to be selected that exceeds these maximum values.

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60601-1-3 / 29.202.9 Accuracy of indication with light field-indicator

Test equipment:
Digital lx-meter, Unfors P11 PRO
Light to X-ray field test pattern

Procedure:
1) Perform setup as shown in figure 29.202.9.1
2) Measure the distance from the focal spot to the plane of interest, and record the value in table 29.202.9.1
3) Select a technique within the range of normal use and take an exposure
4) Make sure that the beam does not exceed the field test pattern
5) Safe the image on the computer
6) Turn on the collimator light
7) Measure the distances a_1, a_2, b_1 and b_2 (see figure 29.202.9.2), and record the measurements in table 29.202.9.1
8) Select another focal spot to plane distance and repeat b) to g) to fill out the table

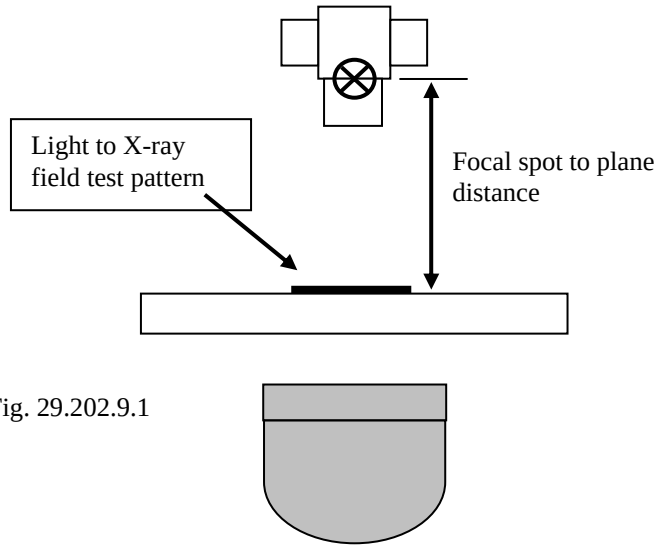

Fig. 29.202.9.1

Spot to plane distance = S	a_1	a_2	b_1	b_2	$\lvert a_1 \rvert + \lvert a_2 \rvert \leq 0.02 * S$	$\lvert b_1 \rvert + \lvert b_2 \rvert \leq 0.02 * S$	Pass/fail

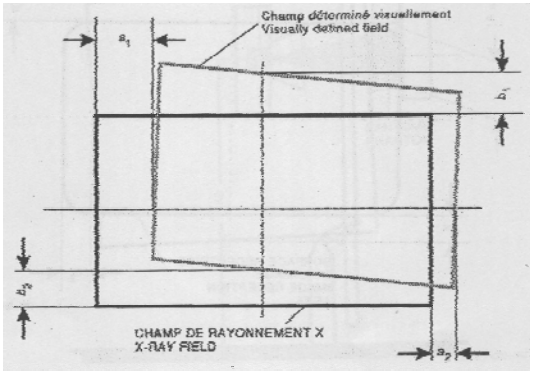

Fig. 29.202.9.2

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